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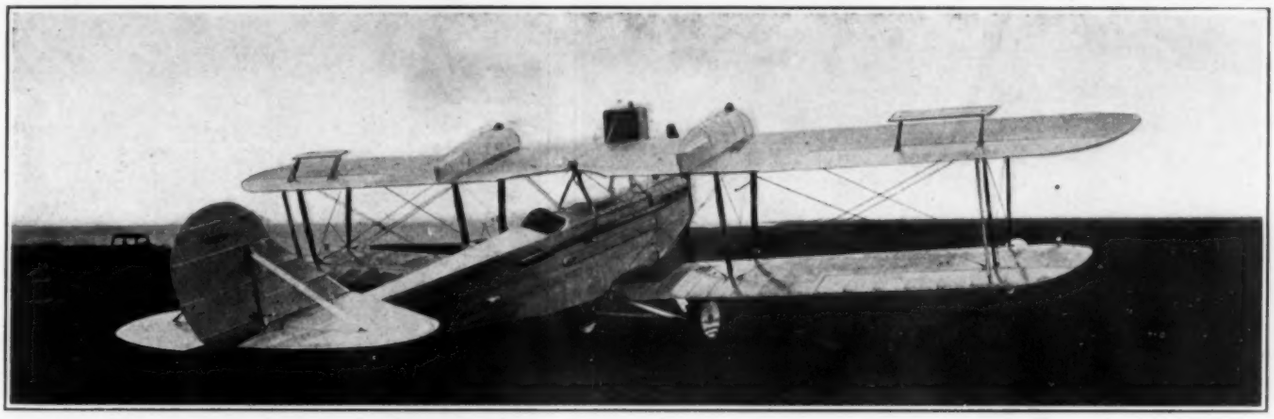


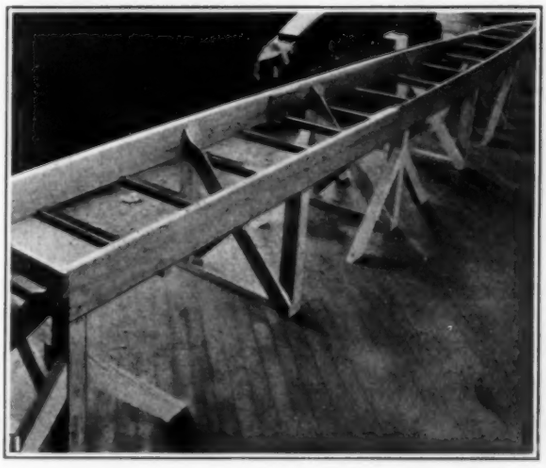
New Metal Airplane for Mail Service

By Fred H. Colvin
Editor, *American Machinist*

Some of the details used in the construction of an all metal fuselage—Methods of forming channels and other special shapes with simple equipment

THE extensive use of metal in airplane construction has long been the dream of many designers and plane manufacturers. But it is a far cry from the day of the fuselage of bamboo tied with wire, to the metal fuselage built by the Aeromarine Plane and Motor Co., Keyport, N. J. The plane illustrated was built especially for the air mail and was designed by Paul G. Zimmerman, chief airplane engineer, after a careful investigation of the characteristics of planes that would meet the requirements of the mail service.

Before going into the details of the metal work it is of interest to note the main characteristics of the plane shown above. It is fitted with a high-compression 400-hp. Liberty motor. The speed varies from 116 miles per hour to a slow landing-speed of 44 miles per hour. While loaded with 600 lb. of mail it climbs 6,800 ft. in 10 min., and has a ceiling, or maximum climb, of 16,200 ft. The wing span is 50 ft., the length 32 ft. 11 in., the height 12 ft. 9 in., and wing area 540 sq.ft. The mail compartment has a capacity of



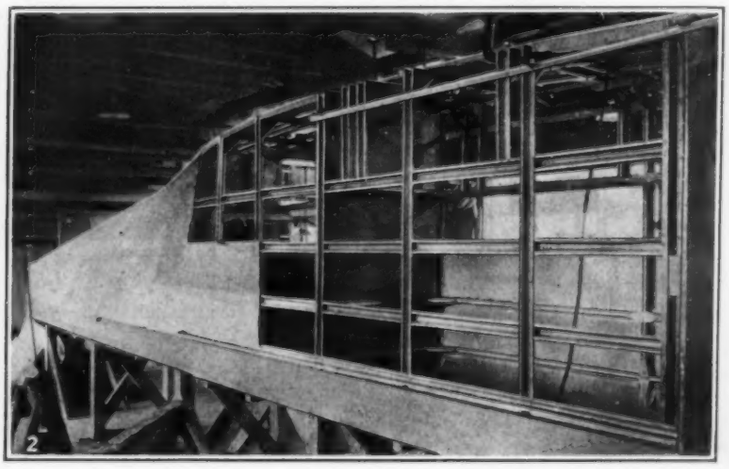
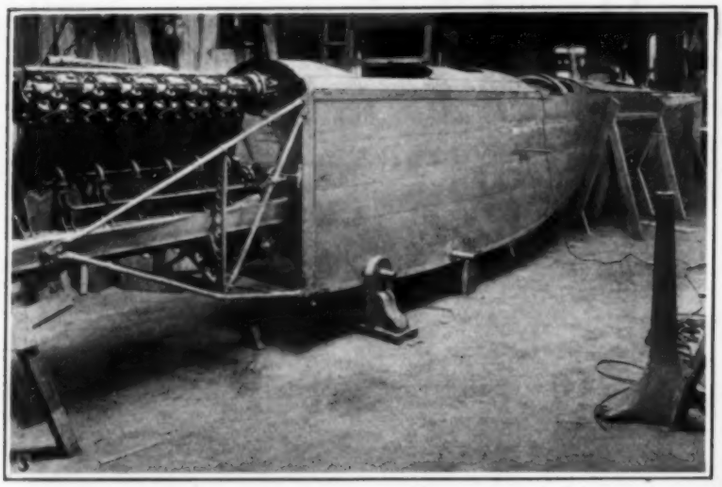
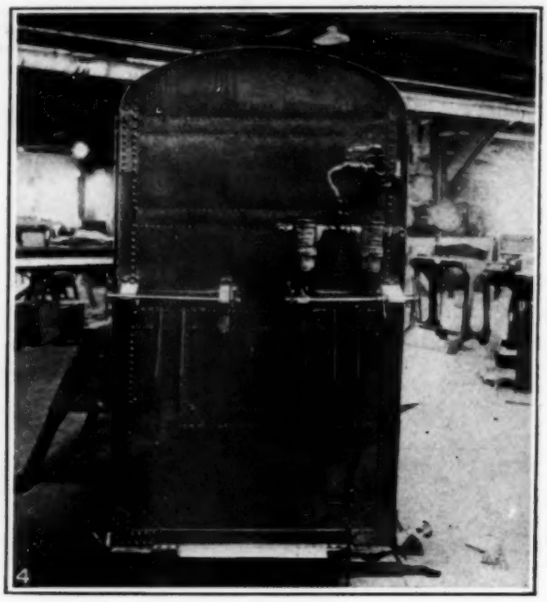
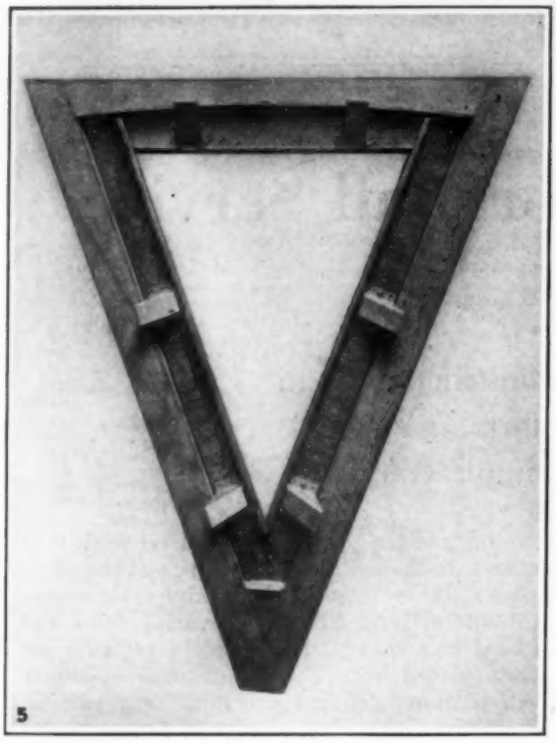
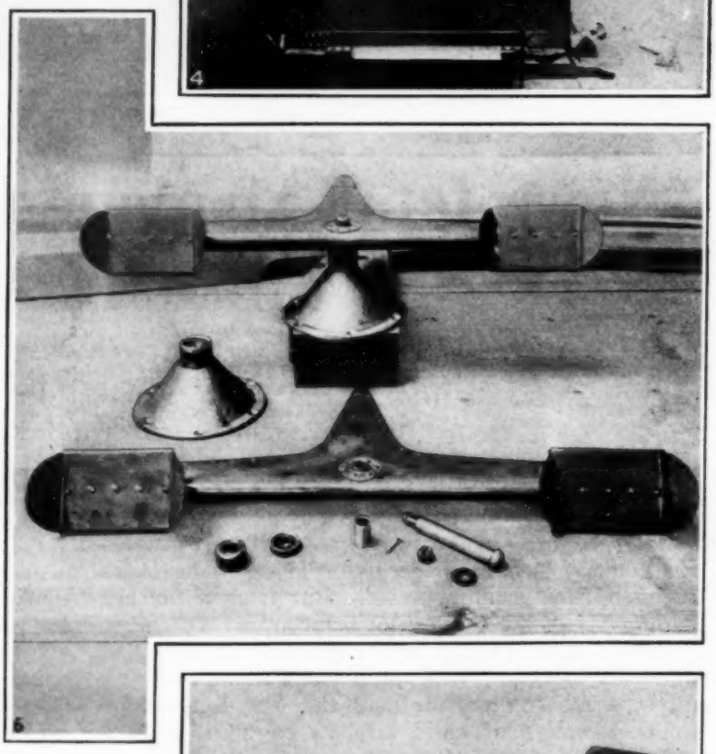


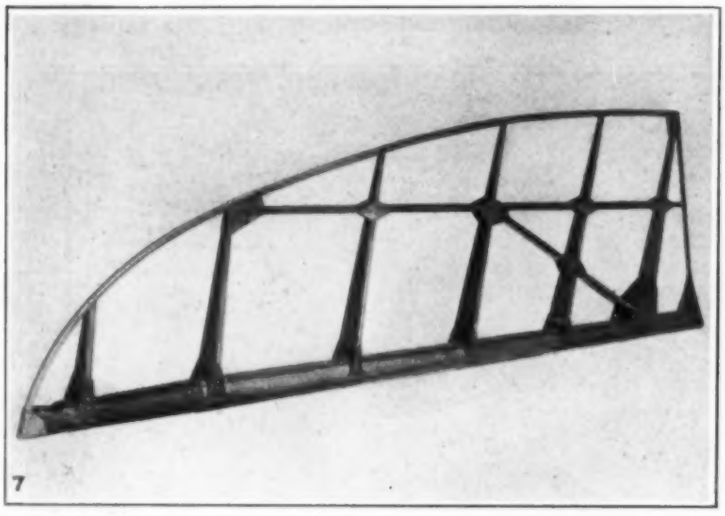
Fig. 1—Fixture for fuselage. Fig. 2—Framework of fuselage











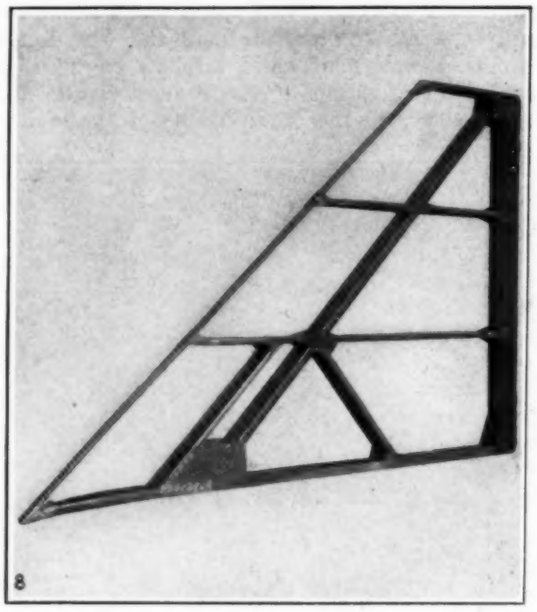


Fig. 3—Fuselage nearly completed. Fig. 4—Front or fire bulkhead. Fig. 5—Form for triangular frame. Fig. 6—Rudder bar assembly. Fig. 7—Elevator frame work. Fig. 8—Frame for tail-fin

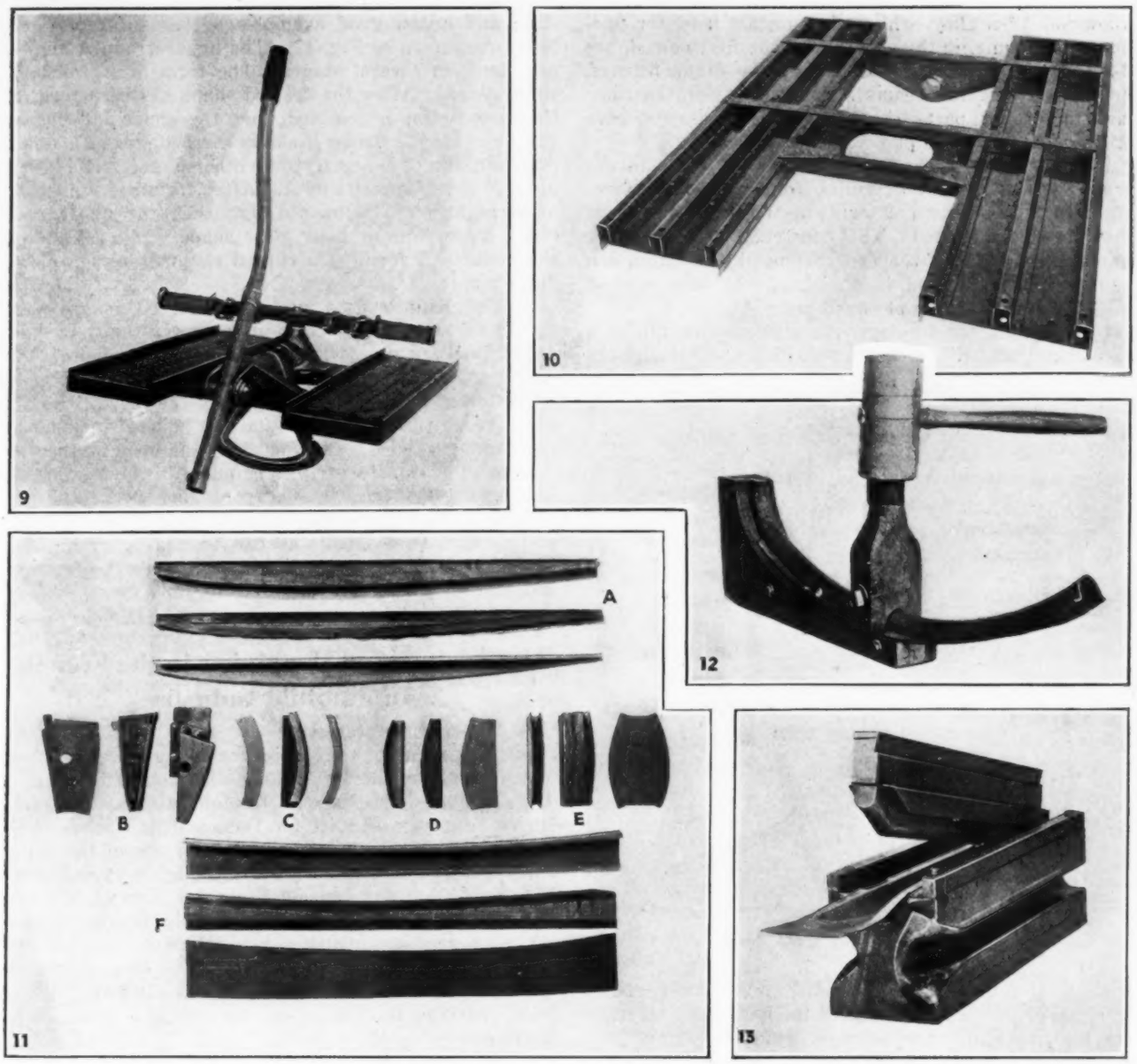


Fig. 9—Control unit assembly. Fig. 10—Construction of floor unit. Fig. 11—Dies for small metal parts Fig. 12—Forming curved channels. Fig. 13—Die for forming channels

45 cu.ft. and will carry 1,125 lb. of mail, but calculations have been made on the basis of 600 lb. of mail. Each of the two gasoline tanks (in the wings) holds 50 gal., while the oil tank carries 12 gal. The total weight, fully loaded is 4,450 lb. A safety feature is a 3-gal. tank of pyrene under pressure. By merely opening a valve the pilot can spray the motor and extinguish any fire that may occur.

For structural reasons the fuselage takes a triangular section back of the wings, which results in saving considerable weight. A plate-girder construction is used with beams, or longerons of channel section. The material is known as 17-S alloy which is an aluminum-copper alloy of great strength. Frames and bulkheads are of metal from $\frac{3}{32}$ to $\frac{1}{8}$ in. thick, while the longerons are of $\frac{1}{8}$ in. thickness. The covering is $\frac{3}{32}$ in. thick. There are heavy reinforcements of $\frac{1}{16}$-in. metal at the cockpit openings and similar places.

While the metal lends itself to duplicate manufacture more readily than wood, the construction of the first few planes does not warrant the dies and fixtures necessary to secure the lowest construction costs. In the building of these planes, however, much ingenuity has been displayed and the forming of special shapes by hand, aided by simple wooden forms is of special interest.

The mail plane itself is shown in the headpiece. The fixture used in building up the fuselage is shown in Fig. 1. Fig. 2 shows the partly completed fuselage upside down on the fixture. It also shows how the frame work is built up of channels, the corners braced, and the way in which the sheets are laid on and riveted.

Nearly all of the metal used is of the newer, light alloys, brought out by the Aluminum Co. of America. Although all aluminum-copper alloys are commonly called "duralumin," this is in reality a trade name applying only to one specific alloy. The metal which takes its place, with at least all of its good qualities, is

known as 17-S alloy, while other metals used for purposes not requiring the strength of the first named, are 2-S and 3-S. Steel is still used for a few major fittings, but 17-S forms the beams and supports for the fuselage and other parts that carry the loads and give stiffness to the whole plane.

The design has been carefully planned so as to use sheets with little or no forming for covering the fuselage, while the beams and struts are built up of sections that are easily formed. This construction is especially important in view of the fact that until production can be materially increased, it is necessary to form most of the shapes used by simple hand methods.

In designing the fuselage, the vertical strength of a sheet has been utilized by so stiffening and bracing the

Fig. 14—Handy tools used

sheet as to prevent either buckling or vibration. To do this, panels not exceeding 9x18 in. have been taken as the maximum unbraced surface, which aids greatly in making a fuselage stiff and safe without undue weight.

Two different thicknesses of sheet metal are used in the construction, one of 0.040 in. and the other of $\frac{1}{8}$ in. Three sizes of rivets have been selected for fastening the sheets. Where two of the thin sheets are to go together $\frac{3}{32}$-in. rivets are used; for a thick and a thin sheet $\frac{1}{8}$ in., and for two $\frac{1}{8}$-in. sheets, $\frac{5}{32}$-in. rivets.

After the framework has been put in shape, the fuselage is turned over and held as in Fig. 3. This illustration shows the bracing, the lower wing connections, the motor mounting, and the front side of the fire wall. The fire wall, or bulkhead, with some of its fittings is shown in Fig. 4. Fig. 5 shows how one of the triangular braces for the rear is built up.

The workmanlike manner is which various units are constructed can be seen in Figs. 6 to 8. Fig. 6 shows the details of the rudder bar in various stages of completion. It will be noted that the rudder bar has a ball bearing on the spindle. Fig. 7 is an elevator frame and Fig. 8 is a tail fin. Fig. 9 is the floor assembly for the pilot's cockpit, which includes the rudder bar and control lever or "joy stick." Fig. 10 shows how rigidly the floor is braced.

The hand-forming of metal requires patience and skill, and a few good examples of parts for another plane are shown in Fig. 11. The upper group *A* shows one shape in several stages. The form is of wood in three pieces. After the desired shape has been formed the center piece is removed, then the upper and finally the lower piece. Group *B* shows three stages of a small stiffener, and *C*, *D* and *E*, three other pieces. The lower piece *F* is the opposite of *A*. After forming, the lower or straight piece is pushed out, then the upper and lastly the middle or hour glass shape. Fig. 12 shows the method of forming a curved channel from a plain flat strip.

As the channels used were standardized, it was possible to form most of them in a power press by the use of the very simple punch and die shown in Fig. 13. All channels have the same radius, but the depth varies for different purposes. Consequently the die in Fig. 13 was made with three depths and can be used for almost any channel needed. Cutting away the ends of the die enables the flat metal strip to be pushed into the die for forming.

Some idea of the variety of tools used in doing work of this kind in a small way can be had by examining Fig. 14. This collection includes formers, holder-ons, and tools of like character.

The Training of Machinists in the French Automobile Industry

It is perhaps interesting and may be of value to consider, in part the discourse recently given by Monsieur Andre Citroen, France's largest manufacturer of automobiles, at a banquet to Monsieur Gaston Vidal, Under Secretary of State for Technical Education.

He claimed that Monsieur Vidal was one of the principal furnishers of material to the machinery industry in France, that the famous Ecole des Arts et Metiers alone furnished a hundred technically trained young men in a twelvemonth thanks to which he was able to absorb them into the Citroen plant and there continue their practical education which would ultimately place them among the élite of the world's automobile engineers.

With respect to the machining of parts and elements in mass, *en serie*, as they put it in France, Monsieur Citroen stated that he had learned much of that method during a recent visit to the United States. Also that he was proceeding with a method of assemblage and stock keeping and handling which were giving results quite analagous to those achieved by the best equipped establishments in America.

It is Monsieur Citroen's further idea that there should be established as a sort of liaison element between the technical school and the practicality of the plant itself, another organism which should especially cater to the various professional elements of the industry in a manner which should enable them to solve many problems which otherwise might be difficult of accomplishment. He evidently refers to a sort of clearing house of ideas applicable to the automobile industry as a whole.

Concluding Monsieur Citroen stated that 4,000 cars of his manufacture had been exported in 1922, 8,000 in 1923 and that orders in hand for export in 1924 exceeded 16,000 cars and would in value exceed 200,000,000 francs, which is about $10,000,000 at current exchange.

Annular Gearing, Its Design and Application

By P. H. Bryant

Principle and method of operation—Action of the gear teeth—Points on design of annular gear sets —Constructions employed to give uniform speed

DURING some months of development work in the application of annular gearing to electric motors for speed reducing attachments, there have come to my attention so many requests for explanation of the principle of the gearing and description of its application as to indicate a general unfamiliarity with this type of gearing and of the purposes to which it may be applied with certain advantages over other types.

This unfamiliarity with the principle and field of usefulness of a very old mechanical movement in both theory and practice, is further evidenced by the regularity with which its possibilities in theory at least, are discovered every few years and exploited in the non-technical press as offering wonderful new and startling possibilities in simplified power transmission. A few weeks ago one of the Chicago dailies carried such a news item on the front page, descriptive of a magical mechanical mechanism that had recently been put on exhibition whereby it was possible for a tiny, high-speed electric motor to lift enormous weights, twist off steel shafts of large diameter, and perform similar herculean tasks that were represented as out of all proportion to the power applied and as an upset to hitherto accepted principles regarding the relations between torque and speed.

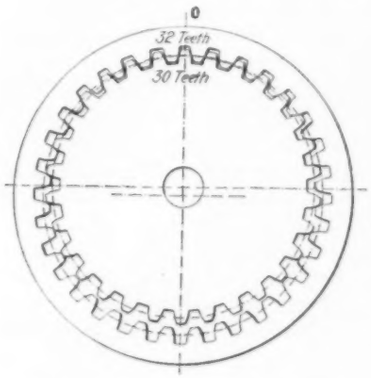


Fig. 1—Layout of annular gears

There was sufficient of mechanical description scattered through the story to identify the device as yet another modification of the principle of annular gearing, although in the particular device described it was stated that no teeth were used, but frictional contact that no load had ever been able to make slip. A final paragraph, however, explained that in applications requiring transmission of considerable power, teeth were used to insure against slipping but that they were not gear teeth in the commonly accepted sense, because "they were in mesh practically all of the time." This last is for a layman a very good description of simple annular gears.

I have referred at some length to this news story, as it will be used later as an illustration of the well-nigh limitless possibilities of swapping speed for torque.

Lest some may question the accuracy of the statement that practical applications of annular gearing are not as new as recurrent exploitations would seem to indicate, it may be said that a reading of patent office records of cases involving applications for patents on forms of annular gearing, discloses that the examiners discard all claims seeking to cover the principle itself, on the ground that it is old in the art. Such claims as have eventually been allowed cover details of design grouped around the gear set as a basis. I have never heard any statement as to the probable date at which annular gearing was first put to practical use; but that the principle was known and used thirty years ago, I can state with certainty, as I saw at about that time its use in a "year clock," the invention of "Pop" Horton, a clockmaker of Bristol, Conn.—the same Pop Horton, by the way, that endeared himself to fishermen by inventing the flexible steel flyrod.

Horton, along with all the clock sharps of that period, was striving to produce a family clock that would have to be wound only once a year. He had solved the problem by taking a standard clock movement and hooking on where the 7-day driving spring was ordinarily attached, a 100:1 ratio annular gear set, the driving gear of which was actuated by a very powerful spring as large in diameter as the confines of the average mantel clock would permit. The spring was wound with a crank through the 100:1 ratio, so the gear elements the designer had added served the double purpose of providing both leverage to make it possible for a person to wind

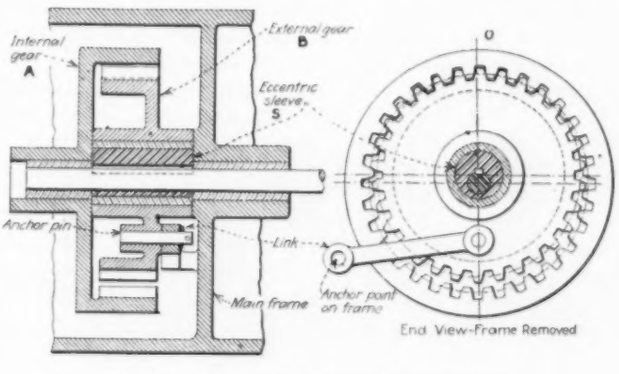


Fig. 2—Diagram of annular gear set

such a powerful spring, and also the multiplication of revolution necessary to drive the clock fifteen to eighteen months while the spring was unwinding.

Harking back to the unfamiliarity of so many to the possible uses of annular gearing, it suggests that it may be profitable, even at the risk of covering some old material, to study and explain the elemental principle in some detail, and discuss briefly both the possibilities and limitations of its use in practical mechanisms.

Principle of Annular Gears

An annular gear set consists of two gear elements, the one an internally cut gear, the other an externally cut or spur gear of the same circular pitch and face but of slightly smaller pitch diameter. The spur gear is mounted eccentric to the internal, the amount of eccentricity being equal to one-half the difference in pitch diameters of the two gears, from which it will be apparent that at one point in the periphery of each gear their pitch lines will coincide, as in Fig. 1.

In applying the annular gear set to practical purpose the internal gear element is always, so far as the writer knows, mounted concentric with the driving or driven shaft, depending on whether the movement is used for reductions or accelerations. The external gear is mounted on an eccentric sleeve, which is keyed to its supporting shaft but turns freely in the external gear. In operation the externally cut gear is held stationary relative to its own axis, by being anchored in some manner to a part of the mounting frame. Understand, however, that the whole mass of the external gear revolves at every turn of the mounting shaft and sleeve, the diameter of its revolutions being equal to twice the eccentricity of the sleeve. These few elements, shown in Fig. 2, namely, the shaft, the eccentric sleeve keyed to the shaft, the externally cut gear turning freely on the sleeve, the link from the external gear to the anchor point holding the external gear from revolving, and the internally cut gear meshing with the external gear and mounted concentric with and free of the shaft, are all that are essential to a speed change gearing of the annular type, although much intricate design has been added to gain certain desired characteristics of operation.

In studying the operation of the gear set, let us assume that internal gear *A* has 32 internally cut teeth and external gear *B* has 30 externally cut teeth. At each revolution of the eccentric sleeve *S*, driven by any source of power, the 30 teeth of the external gear are successively pushed into full mesh with adjacent teeth in the internal gear. After one full revolution of the driving shaft, the external gear having been held rotatively stationary, tooth number 30 of the internal gear will have taken up a position coincident with *O*, the starting point. The two "left-overs" in the 32-tooth internal gear have been forced by the oscillation of the external gear to move forward, or "creep" as it is commonly termed, a distance equal rotatively to one-sixteenth of a revolution. Sixteen revolutions of the driving shaft and sleeve will have forced the larger gear to creep 32 teeth, a full revolution, resulting in a 16 to 1 reduction in speed between the element driving the sleeve and whatever may be driven by the internal gear.

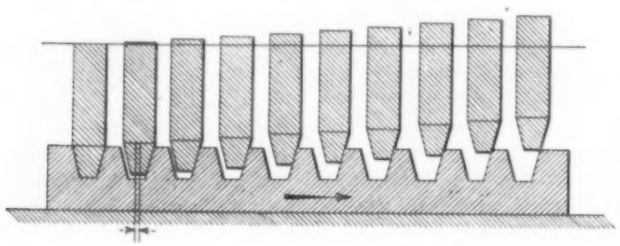


Fig. 3—Wedging action of teeth of annular gears

Throughout this article the basic elements are referred to as gears and the mechanism as a type of gearing, although there will probably never be any end to the controversy set up by those that claim that the elements are not gears at all, and their operation not a true gear action. Without doubt, much of the mystery that has surrounded the applications of annular gearing has been caused by the assumption that it was a modified form of planetary gearing, in which the smaller diameter external gear rolled around inside the larger internal gear.

The reader must understand that external gear *B* does not roll at all, but that its teeth, acting more in the nature of so many equally spaced wedges, are in succession pushed in and out of a corresponding number of beveled sockets spaced the same distance apart, the wedges being in effect simultaneously pushed forward by virtue of the oscillating motion set up by the revolution of the eccentric sleeve. The action is shown in Fig. 3. The two gear elements being substantially locked together and 30 circular pitch units of the external gear having been pushed in and out in a cycle of 360 deg., it follows that 30 circular pitch units of the internal gear will likewise have been forced through a coincident 360 deg. cycle. But, there being 32 circular pitch units in the internal gear in a cycle of 360 deg., any given point on its pitch line will have moved rotatively in the direction of oscillation of the sleeve, two thirty-seconds of a revolution.

Whether it is gearing or not makes little difference, because it can be demonstrated both graphically and practically that a form of tooth can be developed in each of the gears that, in applications requiring comparatively low ratios of reduction, will give the necessary creep with slight relative movement of the surfaces in contact and, in consequence negligible frictional loss or wear at those points.

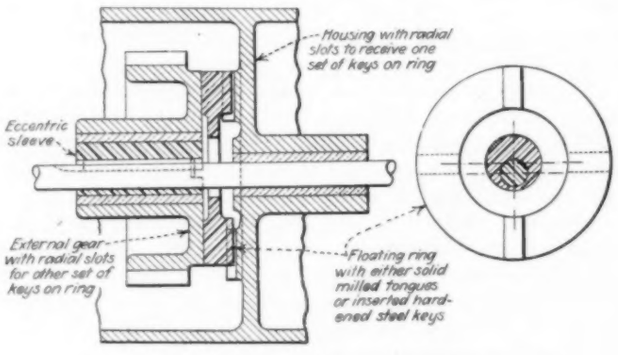

Housing with radial slots to receive one set of keys on ring
Eccentric sleeve
External gear with radial slots for other set of keys on ring
Floating ring with either solid milled tongues or inserted hardened steel keys

Fig. 4—Oldham coupling of annular gear

The possibilities of using an annular gear set advantageously should be considered by every designer where a relatively great change of speed is required, and particularly where it is essential to keep the driving and driven shafts in concentric alignment. In the direction of high ratios there is practically no limit to which

the reduction may be carried, as no difficulties caused by interferences of the points of the gear teeth arise where ratios of 16:1 or greater are used. As the ratio of reduction increases, however, it is plain that the proportions must become so large as to be unwieldy, or the teeth cut so fine as to reduce the torque capacity to a low limit.

Going beyond the practical range of toothed elements, it will be seen that the possibilities of large ratios of reduction are practically limitless. Referring again to the Chicago news story, it would appear from the meager description that the designer used two friction rings, the external surface of one being only a few thousandths of an inch smaller than the internal surface of the outer ring. Given a sleeve wih an eccentricity equal to one-half the difference between the internal and external diameters of the two rings, plus an increment for contact pressure, it will be clear that ratios of reduction could be developed for purposes of demonstration ranging up into the thousandths to one.

This assumption applies to reductions only. For purposes of acceleration the range is sharply limited, depending much on the nature of the service. As the speed of rotation increases, the frictional resistance to acceleration becomes greater, limiting most practical

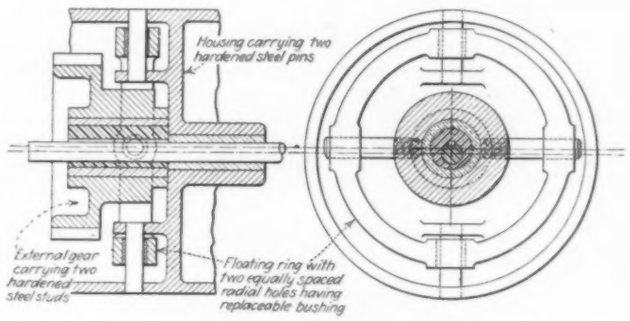

Housing carrying two hardened steel pins
External gear carrying two hardened steel studs
Floating ring with two equally spaced radial holes having replaceable bushing

Fig. 5—Use of modified coupling with removable wear elements

uses of the device for this purpose to about a 20:1 rate of acceleration. Horton in his clock, however, used a 100:1 acceleration to drive it, which was entirely practical as the driving element made only one revolution in twenty days.

To get ratios of less than 16:1 it becomes necessary to increase the pitch angle of the internal gear to prevent the points of the external gear from "hooking." By increasing the angle to about 35 deg. it is possible to get lower ratios, but so great an angle at the point of contact sets up radial stresses that put a sharp limitation on the application in this direction.

Design of Annular Gear

In the design of annular gearing for concrete purposes, the following two formulas must be reckoned with:

(1) The number of teeth in the internal gear must be equal to the ratio of reduction increased by a multiple of two or more.

(2) The number of teeth in the external gear is equal to the number in the internal less the multiple.

For example, if the designer requires a 16:1 change of speed, the least number of teeth possible in the internal gear is 32, but it may have 48, 64, and so on, depending on other considerations to be met by the design. Likewise, the external gear would have 30 teeth in the first instance, but might have 45, 60, etc., depending on the multiple selected.

With these two formulas in mind, the designer can readily determine the specifications of his gear set in the following manner. It is obviously of advantage to have the diameter of the internal gear as large as the confines of the design will permit. Having determined this allowable diameter and computed by standard rules of gearing the pitch of tooth required to transmit the necessary power, the pitch diameter of the internal gear is the quotient obtained by dividing some multiple of

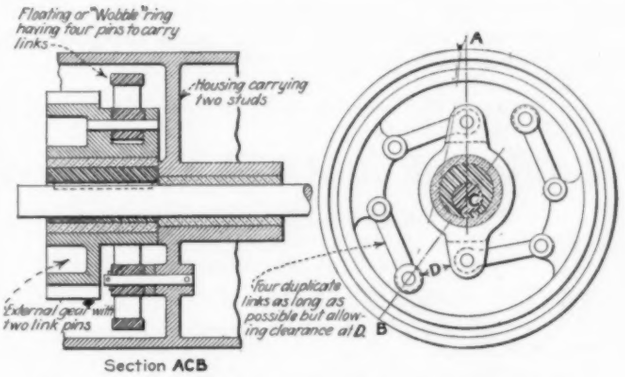

Floating or "Wobble" ring having four pins to carry links
Housing carrying two studs
A
C
D
Four duplicate links as long as possible but allowing clearance at D
B
External gear with two link pins
Section ACB

Fig. 6—Annular gear set with compound linkage

the ratio by the diametral pitch. This quotient may be equal to or less than the largest allowable diameter tentatively determined upon, but it is the closest approximation to it.

For example, assume a case where 10 in. in diameter is the limit for clearance. Deducting sufficient for the body of the gear and root depth of tooth, it is clear that about 8-in. pitch diameter will meet the requirements of the design. Computation of torque in an 8-in. pitch circle determines that a 5-pitch tooth of 2-in. face will have an ample factor of safety. Assuming again the conventional 16:1 ratio, a gear of 5 pitch and 32 teeth would have a pitch diameter of 6.4 in., and a 48-tooth gear a diameter of 9.6 in. The first diameter is impractical, the second impossible.

It then becomes necessary to select the next larger pitch, and the specification of the internal gear is definitely determined as 4 pitch, 8 in. pitch diameter, 32 teeth and 2 in. face. The corresponding external gear would be 4 pitch, 7.5 in. pitch diameter, 30 teeth and 2 in. face. If the designer had considered it safe to use a 6-pitch tooth, he could have specified 6 pitch, 48 teeth in the internal and 45 teeth in the external, and gotten the same result.

It will be noted that the determination of the gear specifications is a cut-and-try process, but this condition is made necessary by the desirability of always using the largest possible gear that the design will permit. In practice it seems to be the tendency of designers to use extra wide face gears, and "stubbed" teeth.

While the elements of an annular gear set are few and simple, it has been found necessary in meeting certain exacting conditions of service to add many more or less complex details. The greatest problem has been the linking of the external gear to an anchorage in a manner to secure uniformity of speed between the driving and driven shaft. Reference to Fig. 2, in which the

internal gear is connected by a single link to the anchor point, will disclose that such a device would transform uniform driving speed into a varying speed, the curve of which would be alternately above and below the line for constant speed, much like a sine curve.

Figures 4, 5 and 6 show three conventional methods of gaining uniformity of transformation, the internal gears being omitted, for the sake of simplicity. In Fig. 4 is an Oldham coupling, practical only for very slow speeds because of difficulties in counterbalancing, and expensive to manufacture and maintain. In Fig. 5 is a modified Oldham coupling, in which the wear elements are hardened and ground pins and bushings, all easily replaceable but equally difficult of counter-balancing because of the movement of the mass being modified by sliding friction.

In Fig. 6 is represented a compound linkage that has been used very successfully. It does not give an absolutely uniform curve of transformation, but so close an approximation as to meet all practical requirements.

Other details of design group around the mounting of all moving parts on frictionless bearings, the methods of counterbalancing the eccentrically revolving masses of the sleeve and external gear, and developing forms of teeth that impart revolution to the driven gear without friction between the tooth faces.

It will be seen from the foregoing that with a proper regard for its limitations, and particularly where it is desirous to obtain great ratios of speed reduction between shafts in concentric alignment, the designer can well afford to give careful consideration to the annular gear set.

Equipping an Ideal Automobile Plant—Discussion

By P. A. Fredericks

WHEN authorities disagree the Ordinary Person is at a loss as to which he should accept. This may be a good thing in that it starts the O. P. on his own line of thought. He then becomes constructively critical, and accepts only that which suits his own experience and judgment. If this happens to result in a third opinion, it will undoubtedly more nearly conform to the Ordinary Conditions usually surrounding the aforesaid Ordinary Person.

Upon a first reading of the article of the above title, I was inclined to agree with the author very largely and started off on a "dream" of my own suggested by the general trend of the article. My dream took the form of an automatic machine with a big hopper on one end into which was to be dumped trainloads of iron ore, pine logs, and paint ingredients by means of an automatic car dumper, and having at the other end an automatic conveyor and car-loader combination to load the completed, painted, and crated product into the cars which were automatically set forward at intervals by a simple dial feed attachment operating in unison with the loader, taking the empty cars from a side track upon which the automatic car dumper had deposited them by means of a gravity feed ejecting mechanism after their contents had been dumped into the hopper.

The S. A. E. Production Meeting

Having thus practically completed the design in all essential elements, I had started on some of the minor details of the mechanism intervening between the hopper and the car loader, when the thought occurred that at the recent meeting of the S.A.E. in Cleveland there had been a production session at which undoubtedly some such arrangement had been discussed, since the main object of the meeting was bringing forward of methods for reducing production expense. If this were true, the petty details of design could be avoided at once which would considerably expedite the building of the machine which I had in mind.

Upon looking up the reports of this meeting I suffered a severe jolt. About the first thing that met my eye was an account of the building of a special machine tool at a considerable cost which was abandoned in three days in favor of standard machines, and the characterization of the designing of special machinery as a "prevailing weakness."

This brought me to the frame of mind mentioned at the beginning of these notes, and after a headache or two, and going over most of the pros and considerable of the "con" on the subject, a little light began to break, as follows:

Special machines are indicated:

1. When it is certain that no change which will render the investment worthless will be made in the manufactured parts for a long period of time.
2. When quantities of production are fixed, regular and large enough to keep the machine busy.
3. When some one can guarantee that the machine will work as expected.
4. When a guarantee can be had that the machine will not cost twice as much as expected.

Some of the Reasons Why Standard Machines Should Be Used

Standard machines with special equipment should be used when any of the above conditions cannot be met, and usually also when they apparently can all be met, because:

1. Production on the large majority of work need not be less on the standard than on the special machine, if properly equipped, provided the machine and special equipment is well chosen.
2. Usually something is overlooked in meeting the conditions necessary to make special machines pay.
3. Attachments ordinarily present less difficulties of design and if errors are made they are less costly.
4. Attachments and special fixtures cost less originally and when they become obsolete still leave a valuable asset in the form of the standard machine on which they fit.
5. Breakdown from any cause is less serious, a different special attachment may be put on the machine and the floor space continue to produce its share.
6. The majority of the mechanism of a production unit has repair parts immediately available if the unit consists of a standard machine plus an attachment.
7. It is easier to find operators for a standard machine and easier to replace an operator quickly when necessary.
8. Most standard machines can be adapted to special operation and high-production work at comparatively small expense, and in a comparatively short space of time after it is determined what is required.
9. Some of the builders of standard machine tools now render a complete production service, including the designing and building of special equipment for their own product, and upon their own responsibility for successful operation and production.

Development of Machine Tools in New England

By Guy Hubbard

The tenth article—American exhibit at Crystal Palace—Famous Enfield (England) Armory equipped with Yankee machinery and tools—Gages sent from England made of wood

IN 1851 the Crystal Palace Exhibition was held in London and American manufacturers were warmly invited to attend, but for some reason the response from this side of the water was very small. The United States section is shown in Fig. 58. As Patent Commissioner Ewbank says in his report for the year 1851: "From the United States three different articles in gunnery only were exhibited. These were the common army rifle, Colt's revolvers, and Maynard's primers. The first of these, manufactured by the Robbins & Lawrence Co., of Windsor, Vermont, received much approbation for the excellent quality of their material, and the thoroughness and completeness of their workmanship."

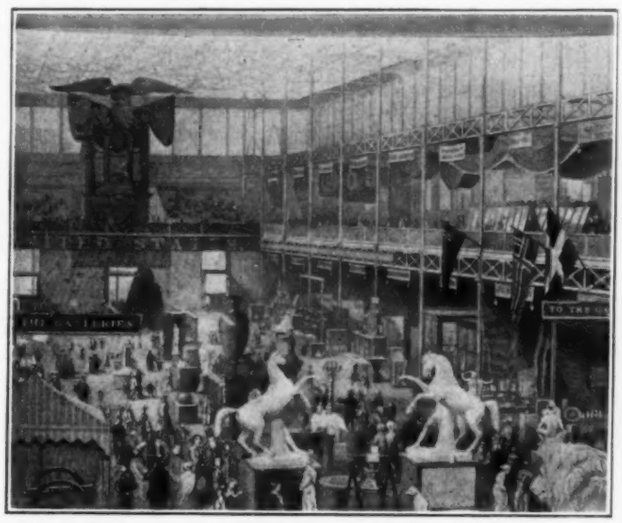


Fig. 58—United States exhibit in Crystal Palace, 1851
(From a Daguerreotype by Mayall)

This last sentence refers to the six interchangeable U. S. Army rifles which, with a representative, were sent to London by the Windsor concern, and which were not only awarded a medal of excellence, but also inspired the following paragraph in the official report, which was highly laudatory, considering the usual conservatism of the English official.

"Of these rifles, manufactured by Robbins & Lawrence, it is but just to say that they are among the best, if not *the* best, of any rifles manufactured in the world. . . ."

These Windsor rifles, which were frequently disassembled, their parts mingled in a promiscuous heap and then perfectly reassembled again to demonstrate their interchangeability, came to the attention of such high engineering and military authorities as James Nasmyth, Joseph Whitworth, and the Duke of Wellington, and—to the engineers at least—they were of deep interest. The British Army rifles of that day, except that they had percussion instead of flint locks, were not much of an improvement over the old "Brown Bess" muskets from which they had developed. They were built in a most primitive manner, there being in England no National Armory in the sense of the word. Under this system the small parts or limbs of the British rifles were mostly made by hand in small shops scattered all over the kingdom—the steel parts being left soft. These crude parts, in the material and workmanship of which there was no degree of uniformity, were eventually collected at the Armory in the Tower of London, where the guns were built up one by one, by filing and reaming the parts to fit each other. All steel parts to be hardened were then marked to indicate the gun to which they belonged and were removed for heat treating. Such a system was not only slow, but produced arms of doubtful quality and precluded the possibility of intechangeability and the resulting use of ready fitted repair parts. The failure of even a minor part in the field would render one of these guns useless until it could be repaired by the professional armorer who, with forge and tools, was attached to each regiment.

With the Crimean war a certainty, James Nasmyth, who as an engineer, fully realized the grave arms situation which existed in England and recognized the value of the American system of manufacture, in 1853 hastened the organization of the Royal Small Arms Commission. The organization of such a commission had previously been blocked by the opposition of the aged Duke of Wellington, who died in 1852, and who to the last insisted upon the superiority of that type of arm which had served him so well at Waterloo. Plans were now rushed through for the establishment of a complete Royal small arms manufactory at Enfield Lock, Middlesex, where the improved Model 1853 Enfield Rifle could be entirely manufactured upon the interchangeable system.

In February, 1854, Chairman James Nasmyth of this Commission, who was himself detained in England by his pressing duties there, dispatched to the United

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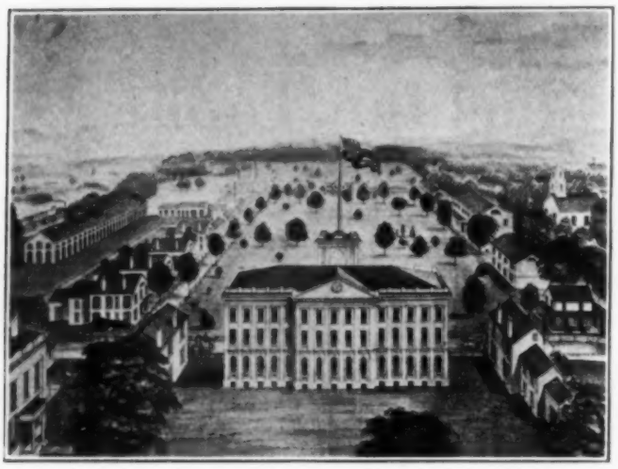


Fig. 59—Springfield armory, 1854
(From an old lithograph)

States Sir John Anderson, Ordnance Inspector of Machinery; Lt. Col. Robert Burn and Lt. Thomas Picton Warlow of the Royal Artillery, under the title of the "Committee on the Machinery of the United States of America." The Army and Navy authorities at the instance of Secretary Jefferson Davis quite outdid themselves to show these English gentlemen the entire workings of the United States Armories and Navy Yards, while private manufacturers were no less obliging. The account of the reception of this commission, as well as its appreciation of it, as presented in its "Address to the House of Commons" on July 10, 1855, is one of the pleasantest chapters in Anglo-American relations that was ever recorded. This same report is, by the way, one of the most interesting and fruitful sources of mechanical historical information which the writer has yet discovered.

After Colonel Ripley and his Ordnance officers at the Springfield Armory (see Fig. 59) had demonstrated the manufacture of the interchangeable Springfield rifle, and had advised the Commission upon certain changes in the design of its new Minie rifle, the Englishmen placed a large order for Blanchard's gun stocking machinery with N. P. Ames of Chicopee, Mass. (now the Ames Sword Co.), and then proceeded to Hartford, Conn., where its report says; " . . . the Committee went over an armory belonging the Messrs. Robbins & Lawrence, of Windsor, Vermont, in which they are manufacturing Sharps' breech-loading carbine and rifle for the company who hold the patent of it. This factory is only just established, and all the machinery was not complete at the time the Committee visited it, but it seems to be conducted upon the best manufacturing principles, machinery being applied to every part of the arm. The Committee was so struck with the beauty and efficiency of the machines here used, that, finding they were made by Messrs. Robbins & Lawrence of Windsor, Vermont, they entered into the subject of the manufacture of fire-arms by machinery with Mr. Lawrence, who accompanied them over the works, and who proved to be perfectly conversant with this branch of the trade, and having showed him the different parts of the musket required to be produced, he undertook to make out and forward to them a tender for the necessary machinery, on behalf of the firm in which he is a partner."

A Large Foreign Contract

In August, 1854, the Committee journeyed to the Robbins & Lawrence armory at Windsor, Vermont, and the result of its visit was that this backwoods concern was given the contract for practically all the standard and special machine tools for the new Enfield armory. This contract covered about 150 machines, tooled up to manufacture the various metal components of the 1853 Enfield Minie rifle, and also included numerous jigs, fixtures and gages. In the list of machines appear such apparently modern items as "4 and 6 spindle drilling machines," "Double milling machines," "Screw milling machines," and "Universal milling machines." Plain milling machines, predominate in this contract.

A large force of men was immediately set to work at Windsor upon this machinery contract and it was promptly and satisfactorily completed. Meanwhile, in the Spring of 1855, the construction of the buildings at Enfield, which were of the most advanced type and arrangement, was begun, and when in March 1856, Maj. Alfred Mordecai, as Commissioner of the U. S. Ordnance Department visited this new "Royal Small Arms Manufactory," he reported; " . . . a considerable part of the machinery was in operation . . . the names Ames, of Springfield, and Robbins & Lawrence, of Windsor, Vermont, etc., are to be read on most of the machines at Enfield Armory, and are constructed in a style highly creditable to the skill of our workmen." See Fig. 60.

In 1857 the Royal Armory was turning out Enfield Minie rifles by the use of these machines at the rate of 1,000 per week, which would seem to have proved their efficiency.

After this visit to Windsor the Commission returned to England, and through its recommendation a contract

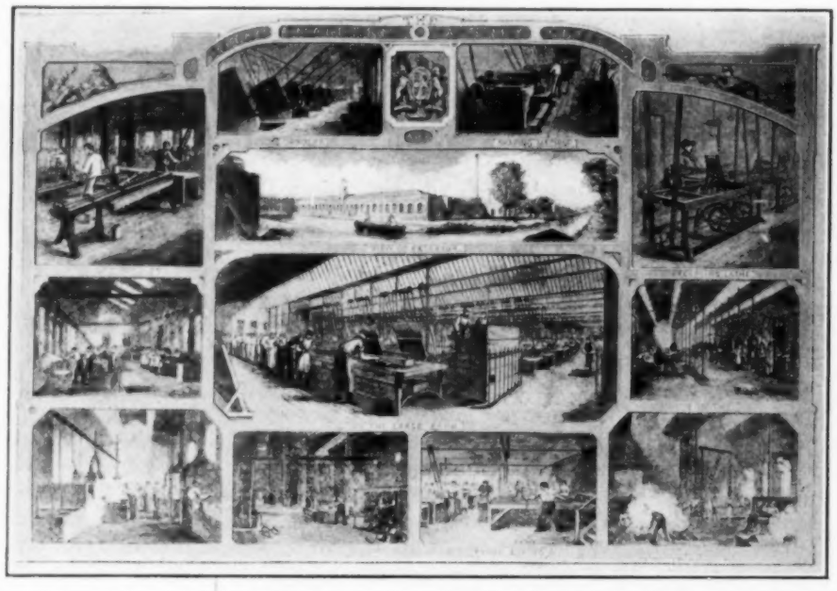


Fig. 60—Early views of English armory, 1860
Courtesy Illustrated London News

was awarded to the Robbins & Lawrence Co., for the first 25,000 interchangeable Enfield Minie rifles. As the Crimean War (1853-1856) was then in progress, the English were desperately in need of guns, and these 25,000 were ordered to tide them over during the construction of the Enfield Armory. While the British machinery contract had been a profitable undertaking, this great Enfield rifle contract, on top of the unsuccessful railway car venture, was to prove the undoing of the Robbins & Lawrence Co. and to bring to an unfortunate close one of the illustrious chapters in the history of industrial development in the United States.

Fig. 61—Enfield minie rifle built by the Robbins & Lawrence Co. for the British Government
(From the author's collection)

The Minie rifle contract was given through Fox, Henderson & Co. as agents of the British War Office. This company, consisting of Sir Charles Fox and John Henderson, Esq., with offices at 8 New Street, Spring Garden, London, was the builder of the Crystal Palace and in its days apparently held the position now held by Vickers, Limited, in the British engineering field. The fatal contract, negotiated by one Dr. Black, the American agent of the British company, was signed on March 8, 1855, and in it Fox, Henderson & Co. agreed to pay $15.50 each for the rifles and bayonets complete—advancing the sum of twenty thousand pounds ($4 per rifle) to finance the execution of the work. Unfortunately for the Robbins & Lawrence Co. this contract was of the so-called "Penalty" variety, and provided that should the Windsor company fail to maintain satisfactory deliveries, Fox, Henderson & Co. might at any time rescind the contract and collect a penalty of $5 on every undelivered rifle. It was so worded as to provide for vigorous prosecution of the work, but omitted to specify the limit of time for completion. It was said to be understood, however, that it was based upon the supposition that deliveries of rifles would begin in June, 1855, and would be completed about twelve months thereafter—thus demanding an average production of 650 rifles per week.

Richard S. Lawrence throws some light upon the reason for signing such a dangerous contract by the following statement: "Before this contract was taken we had the assurance of Dr. Black—Fox, Henderson & Co.'s agent—that he had in his pocket contracts for 300,000 more, to be given as soon as we finished the 25,000, but I did not like to enter into this contract for 25,000 only, as the outlay for the work would cost more than the profits—twice over. I therefore objected to signing the contract without seeing the large contract in Dr. Black's pocket, and proposed to ask the Doctor to show it. This Mr. Robbins objected to strongly, saying that it would be an insult to Dr. Black. After a long talk I yielded the point, but I told Mr. Robbins that the minute we signed the contract we would be floored—that we had better cut off our right hands. We signed the contract and it did prove that Dr. Black had no additional contract."

An interesting insight into the condition of the mechanic arts in England at that period is given by the following incidents:

Before work upon the rifle contract was commenced, the Robbins & Lawrence Co. called upon the War Office for sample Model 1853 Enfield rifles to work from. These were promptly sent but upon disassembling them it was discovered that no two of them were alike. A set of accurate gages was then requested and these were also promptly sent. They were made of hard wood—originally accurate possibly to $\frac{1}{64}$ in.—but during their sea voyage they had suffered from dampness and were warped and swollen. With this more or less useless material at hand, the Robbins & Lawrence Co. proceeded to make a drawing of the Enfield rifle as it believed it was intended to be, and from this drawing was built an extremely accurate "master gun." Sets of hardened steel gages, carefully oilstoned after hardening, were made to fit the parts of this master gun and sets of accurate jigs and fixtures were built around the parts. The company was then ready for business on the big contract, and while it may

THE ROBBINS AND LAWRENCE COMPANY

BELL CARD.

AVERAGE,—TEN HOURS FOR THE YEAR.

JANUARY.						FEBRUARY.						MARCH.						OCTOBER.						NOVEMBER.						DECEMBER.					
1	7.26	12 n.	12.45	4.55		1	7.8	12 n.	12.45	5.32		1	6.29	12 n.	12.45	6o'c		1	6.00	12 n.	1 o'c	6o'c		1	6.57	12 n.	12.45	5.13		1	7.14	12 n.	12.45	4.41	
2	7.26	"	"	4.56		2	7.7	"	"	5.34		2	6.27	"	"	6		2	6	"	"	6		2	6.59	"	"	5.12		2	7.15	"	"	4.41	
3	7.26	"	"	4.57		3	7.6	"	"	5.35		3	6.25	"	"	6		3	6.2	"	"	5.59		3	6.59	"	"	5.10		3	7.15	"	"	4.42	
4	7.26	"	"	4.58		4	7.5	"	"	5.37		4	6.23	"	"	6		4	6.4	"	"	5.58		4	6.41	"	"	5.9		4	7.16	"	"	4.42	
5	7.26	"	"	4.59		5	7.4	"	"	5.38		5	6.21	"	"	6		5	6.5	"	"	5.57		5	6.43	"	"	5.8		5	7.17	"	"	4.42	
6	7.25	"	"	5o'c		6	7.3	"	"	5.39		6	6.20	"	"	6		6	6.6	"	"	5.56		6	6.44	"	"	5.6		6	7.17	"	"	4.42	
7	7.25	"	"	5.1		7	7.1	"	"	5.41		7	6.18	"	"	6		7	6.6	"	"	5.55		7	6.46	"	"	5.4		7	7.18	"	"	4.42	
8	7.25	"	"	5.2		8	7o'c	"	"	5.42		8	6.16	"	"	6		8	6.7	"	"	5.54		8	6.47	"	"	5.2		8	7.19	"	"	4.42	
9	7.25	"	"	5.3		9	7	"	"	5.43		9	6.14	"	"	6		9	6.8	"	"	5.52		9	6.48	"	"	5.1		9	7.19	"	"	4.43	
10	7.24	"	"	5.4		10	6.57	"	"	5.45		10	6.13	"	"	6		10	6.10	"	12.45	5.50		10	6.49	"	"	5o'c		10	7.20	"	"	4.43	
11	7.24	"	"	5.5		11	6.56	"	"	5.46		11	6.11	"	"	6		11	6.11	"	"	5.48		11	6.51	"	"	4.59		11	7.21	"	"	4.43	
12	7.24	"	"	5.7		12	6.55	"	"	5.47		12	6.9	"	"	6		12	6.13	"	"	5.46		12	6.52	"	"	4.58		12	7.22	"	"	4.43	
13	7.23	"	"	5.8		13	6.53	"	"	5.49		13	6.7	"	"	6		13	6.13	"	"	5.44		13	6.53	"	"	4.57		13	7.23	"	"	4.43	
14	7.23	"	"	5.9		14	6.52	"	"	5.50		14	6.6	"	"	6		14	6.14	"	"	5.42		14	6.55	"	"	4.56		14	7.23	"	"	4.42	
15	7.22	"	"	5.10		15	6.50	"	"	5.52		15	6.4	"	"	6		15	6.16	"	"	5.40		15	6.56	"	"	4.55		15	7.24	"	"	4.42	
16	7.22	"	"	5.11		16	6.49	"	"	5.53		16	6.2	"	"	6		16	6.17	"	"	5.38		16	6.57	"	"	4.54		16	7.24	"	"	4.43	
17	7.21	"	"	5.13		17	6.47	"	"	5.54		17	6oo	"	1oo	6		17	6.16	"	"	5.36		17	6.58	"	"	4.53		17	7.25	"	"	4.43	
18	7.21	"	"	5.14		18	6.46	"	"	5.56		18	6	"	"	6		18	6.18	"	"	5.34		18	6.59	"	"	4.52		18	7.26	"	"	4.43	
19	7.20	"	"	5.15		19	6.44	"	"	5.57		19	6	"	"	6		19	6.20	"	"	5.32		19	7o'c	"	"	4.51		19	7.26	"	"	4.44	
20	7.19	"	"	5.16		20	6.43	"	"	5.58		20	6	"	"	6		20	6.22	"	"	5.31		20	7.1	"	"	4.50		20	7.26	"	"	4.44	
21	7.19	"	"	5.18		21	6.41	"	"	5.59		21	6	"	"	6		21	6.23	"	"	5.29		21	7.2	"	"	4.49		21	7.27	"	"	4.44	
22	7.18	"	"	5.19		22	6.40	"	"	6o'c		22	6	"	"	6		22	6.24	"	"	5.28		22	7.4	"	"	4.48		22	7.28	"	"	4.45	
23	7.17	"	"	5.20		23	6.38	"	"	6		23	6	"	"	6		23	6.26	"	"	5.26		23	7.6	"	"	4.47		23	7.29	"	"	4.46	
24	7.16	"	"	5.22		24	6.36	"	"	6		24	6	"	"	6		24	6.27	"	"	5.25		24	7.7	"	"	4.46		24	7.29	"	"	4.46	
25	7.15	"	"	5.23		25	6.35	"	"	6		25	6	"	"	6		25	6.27	"	"	5.23		25	7.8	"	"	4.45		25	7.30	"	"	4.47	
26	7.14	"	"	5.24		26	6.33	"	"	6		26	6	"	"	6		26	6.28	"	"	5.22		26	7.10	"	"	4.45		26	7.28	"	"	4.48	
27	7.14	"	"	5.26		27	6.32	"	"	6		27	6	"	"	6		27	6.30	"	"	5.20		27	7.11	"	"	4.43		27	7.29	"	"	4.48	
28	7.13	"	"	5.27		28	6.30	"	"	6		28	6	"	"	6		28	6.32	"	"	5.19		28	7.12	"	"	4.44		28	7.29	"	"	4.49	
29	7.12	"	"	5.28		29	6.30	"	"	6		29	6	"	"	6		29	6.33	"	"	5.18		29	7.13	"	"	4.44		29	7.27	"	"	4.50	
30	7.11	"	"	5.29								30	6	"	"	6		30	6.35	"	"	5.17		30	7.14	"	"	4.44		30	7.27	"	"	4.50	
31	7.10	"	"	5.31								31	6	"	"	6		31	6.36	"	"	5.15								31	7.26	"	"	4.51	

From April 1st to October 1st, the Bell will ring to commence work at 6 A. M. and at 1 P. M.; to cease work, at 12 M. and at 6 P. M.
From April 1st to October 1st, the Bell will strike in the morning at 4.30; and from October 1st to April 1st, at 5 o'clock.

	JANUARY.	FEBRUARY.	MARCH.	APRIL.	MAY	JUNE.	JULY.	AUGUST.	SEPTEMBER.	OCTOBER.	NOVEMBER.	DECEMBER.
AVERAGE.	5.20	5.24	10.33	10.50	11	11	11	11	10.43	9.45	8.34	7.54
DIVISION OF TIME. a. m.	9.45	9.37	9.10	9.15	9.15	9.15	9.15	9.15	9.15	9.10	8.33	8.49
DIVISION OF TIME. p. m.	2.55	2.15	3.32	3.45	3.45	3.45	3.45	3.45	3.45	3.0	2.48	2.49

Fig. 62—Schedule of "daylight saving" at the Windsor Armory, 1856

not have attained micrometer accuracy, for the simple reason that it had neither micrometer nor vernier calipers at that time, nevertheless it worked very closely to its gages, making every part like every corresponding part, thus attaining absolute interchangeability in this stand of arms. It has been stated by good authority that this system of jigs, fixtures and gages then used by the Robbins & Lawrence Co. was fully twenty years ahead of its time. In Fig. 61 is shown one of the Enfield rifles made under this contract.

Valiant effort was made by the Robbins & Lawrence Co. to carry out this contract—new shops with much special machinery being built at both Windsor and Hartford for this purpose, and with the other 300,000 in view. At Windsor a "Resin Gas Plant" was installed so that the work could be pushed night and day, and before the lights were put in what may have been the earliest official "Daylight Saving" plan was in force there. This was designed so that an average of ten hours per day for the year might be worked, though individual working days were adjusted to suit the season. The plan was to gradually lengthen the working day during the months of January, February and March, to a maximum of eleven hours (6 to 6 with one hour at noon) maintained from April 1 to Oct. 1—then to gradually shorten the day until a minimum of nine hours and nineteen minutes (7:26 to 4:45 with forty-five minutes at noon) was reached on Dec. 22. A special calendar or "Bell Card," was given to each employee to hang up at home so that he might know what time to go to work each day, and the armory bell was rung accordingly. At the bottom of the card it is naively stated that "From April 1 to Oct. 1, the bell will strike in the morning at 4:30; and from Oct. 1, to April 1, at 5 o'clock." Those were most certainly the days of "Early to bed and early to rise."

Reclamation on the Southern Pacific

By E. J. Becker

General Inspector of Stores, Southern Pacific Co.

RECLAMATION of material is the recovery of money otherwise lost. It means the recovery or salvaging of material unsuitable or unsafe in its existing condition for further use, which, by wisely directed expenditure, can be renewed to further serve its original purpose or made fit for other usage.

Stimulation of greater interest in this work on our railroads is to be desired as the opportunities for further accomplishment in reclamation are limitless. Continued educational efforts in all branches of the service are necessary to properly acquaint everyone with the startling economic possibilities which lie in this direction. The limit is reached only when materal disposed of as scrap is scrap in the exact sense of the word. To augment interest in this subject, the Southern Pacific Company takes pleasure in briefly presenting a few of its reclamation practices.

The "balance sheet" for 1922 reads as follows:

Savings by Reclamation

Value of reclaimed material if purchased new		$1,102,091.12
Scrap value	$136,777.28	
Reclamation cost	229,804.79	
Total cost		366,582.07
Savings effected		$735,509.05

Reclamation of Locomotive Strainer Boxes—Strainer boxes used between locomotive and tender, which have been discarded on account of worn or battered threads are again made serviceable by removing old threads by machine, building up by oxy-acetylene process, and rethreading. We now have a strainer box as good as new for 35 per cent of the article's original cost.

Broken Monkey Wrenches—Wrenches are made serviceable by building up with brass—oxy-weld process—effecting a saving of 50 per cent on broken parts which otherwise would be scrap. Tools of a similar nature are also repaired in this manner.

Reclamation of Couplers—Couplers condemned on account of worn shanks are again returned to service be removing the worn part of shank by the use of the cutting torch, and welding in place a piece of scrap boiler plate of proper size, at an average saving of 22 per cent of the cost of new. When repaired, each coupler is stamped with the initial of the mechanic doing the work, also the date and shop. In two years we have repaired a total of 6,277 couplers and only three were returned or reported as failures.

Building Up Worn Chafing Irons—Another item in which considerable saving has been effected is the building up of chafing irons by means of the oxy-acetylene process. In the old days when a chafing iron became worn beyond a certain point it found its way into the scrap. This also applies to carrier columns and many similar items.

Continuous Joints or Angle Bars—Badly battered or cracked joints are made serviceable by means of the oxy-acetylene process, and their use for spur or secondary tracks has proved highly satisfactory.

Building Up Switch Points or Point Rails—The oxy-acetylene building up process has been responsible for this railroad reclaiming 3,000 switch points during the past two years, at an average cost of 40 per cent of the new value, and so far have had no failures. Switch points broken up to 10 in. are being built up. They are not being used in main line tracks as yet; so far they have been confined to secondary and spur tracks.

Repairing Track Frogs—Track frogs are being built up by the same process, used for the same purpose, and with the same success.

Crossing Frog Built Up in Track—Crossing frogs built up by the oxy-acetylene process in high speed track, have on close inspection, after 8 months service, shown very little signs of wear. 396 trains pass over some of them every 24 hours.

Repairing Chipped Rails in Main Line Track—The battered or chipped ends of rails are built up by traveling frog gangs in the tracks without removing or disconnecting. There are a number of these rails that were built up over three years ago, and they show little or no sign of wear. The majority of the welds are 3 or 4 in. each side of the joint, making 6 to 8 in. of welding. The work costs an average of $2 per joint (two rail ends). 50,000 rails have been so repaired to date.

Presented at the September, 1923, meeting of the San Francisco Section, American Welding Society.

Direct or Alternating Current for Overhead Traveling Cranes

By William L. Laing

Advantages and disadvantages of each type—Selecting a crane motor with characteristics to fit the work — Speed, braking, overload capacity, service and other characteristics

IN HANDLING service correspondence and paying service calls, the writer has found so many engineers and shop superintendents who have to decide the type of crane to install and who are unfamiliar with the different characteristics of the various types of cranes, that he hopes the following comparisons may help some buyer in deciding which type of crane will best fill his needs. This article will treat only of the motors for use on overhead traveling cranes.

A direct-current crane has the following points in its favor. The motor speed characteristics in all motions except lowering are ideal for this service, inasmuch as the speed varies directly with the load; that is, the lighter the load the faster the motor runs. In hoisting, the motor speed will vary about 250 per cent between no-load and full load. The speed of the cross and longitudinal travel motors will vary about 50 per cent between no-load and full load.

THE title might indicate that this article was more suitable for an electrical magazine than for one in the mechanical field. However, it is the belief of the writer that a large number of cranes are bought by men who do not have specialized training in electricity. This class of men will welcome a discussion of the relative merits of direct and alternating current for cranes, particularly since the article is written from their viewpoint and without the technical terms of the electrical profession.

Therefore, with a direct-current crane on service in which the loads vary greatly and where light loads predominate, a larger number of trips can be made in any given time than with alternating-current equipment. Or, if a certain amount of material has to be moved in any given time, slower speeds under load can be used, thus requiring smaller motors than for alternating current, making a saving in the first cost of the crane, and cutting down both the peak current and the total amount of current used. It has been proved by experience that a slow-speed crane gives less trouble and costs less to maintain than a crane which runs at a higher speed.

Bare conductor wires and collectors are more or less a source of trouble. Therefore, a direct-current crane has the advantage in that the motors require only four conductor wires, whereas an alternating-current motor requires six conductors, with the corresponding extra connections to give trouble.

Where the headroom is limited a dynamic braking limit switch can be used, which gives a positive stop in a few inches, the distance depending on the speed.

Dynamic lowering can be used, in which system the energy due to lowering of the load is dissipated in the electrical resistance, which can be made with as large a radiating surface as is necessary. With other types of brake this energy has to be wasted through a mechanical load brake, which is bound to give more or less trouble and be a source of expense for renewal of the friction materials, and which in most cases takes an excessive amount of lubricant. This lubricant is usually distributed fairly and impartially on all the surrounding scenery whenever the friction brake gets hot, and on continuous service the brake has to get hot or it isn't doing any work.

To be fair, however, it should be pointed out that the speed characteristics of a d.c. crane motor when lowering with dynamic braking. are reversed to what they should be. On light loads the lowering speed is usually about half the full-load hoisting speed, and with the full load on the crane hook the load lowers at about 150 to 200 per cent of full-load hoisting speed.

In stopping the load when lowering with dynamic braking, the speed of the load absolutely follows the movement of the controller handle, and by the time the controller handle is in the "off" position the mechanism is practically stopped. The electric solenoid brake has very little work to do, except hold the load in the neutral position of the controller.

Leaving out of consideration any accident to the mechanical parts of the crane, with dynamic braking the only way that the load could drop out of control would be when, with the controller in the hoist position, the current would go off and the electric brake would jam when released. Of course, if an open circuit developed in any part of the armature circuit and the operator should leave the controller in the operating position on the lowering side, the load would drop out of control; but shutting off the controller or opening the main switch would set the brake and hold the load.

Dynamic braking has one other disadvantage, inasmuch as with no load on the hook the motor draws a very heavy current. This current may be 150 to 200 per cent of the full-load current, the exact amount

varying with different types and kinds of controllers.

The speed of a direct-current motor is directly proportional to the voltage at the motor terminals, and therefore the control on all motions is very accurate. A good operator can move the load ¼ in. or less at any time.

It is practically impossible to stall a d.c. crane motor. Therefore in an emergency very heavy overloads can be lifted with the crane. In fact, the writer has no hesitation in lifting 100 per cent overload with any standard crane, and he has run across instances where 200 to 300 per cent overloads have been lifted without accident.

Advantages of A.C. Crane Motors

In many cases alternating current only is available; and except for foundry service and other cases where very fine control is required, the writer believes the a.c. cranes have been perfected to the stage that it does not pay to install a motor-generator so as to have direct current, unless the direct current is of use also for supplying motors in other parts of the plant where variable-speed motors are an advantage, or where a synchronous motor would pay, for the purpose of improving the power factor.

However, the a.c. crane motor has been brought to a very high state of development and it has a number of good points. These motors are very simple and rugged; and as they have no commutator, they give but little trouble. The wiring is very simple and easily understood by the average crane repair man. As the resistance is not connected to the supply, a ground does not cause much trouble.

The crane cannot be dangerously overloaded, because an a.c. crane motor cannot be depended on to start much more than a 25 per cent overload. This statement seems to contradict the corresponding paragraph regarding the d.c. crane, but extreme overload capacity is not an unmixed blessing, as frequent and heavy overloads mean lots of trouble and very heavy repair expense. Also, of course, every time an overload is lifted a chance is taken of having an accident, with the company responsible in case of personal injuries.

Even if all the brakes on the a.c. equipment fail, the load cannot drop faster than about 20 per cent above full-load hoisting speed.

Motors on Bucket Cranes

While the writer has no figures to prove it, he believes that the controller maintenance is more expensive on d.c. than on a.c. cranes, as for some reason there is less arcing and burning in a.c. controllers.

On bucket cranes with two a.c. hoist motors the bucket can be lowered much more easily, as the motors will run at practically the same speed regardless of which motor is carrying the load. However, with a d.c. dynamic braking crane, unless the bucket is lowered slower than full speed, the motor with the load will run faster than the motor without the load, and the bucket will close and thus waste the time necessary for reopening it.

An a.c. bucket crane or any type of crane on which close regulation is not required does not need any mechanical or electrical load brake, and the lowering speed cannot increase much above full-load speed. One standard electric brake is all that is required for each hoist. However, it is advisable, if possible, to use a larger brake than standard to avoid excessive wear on the brake lining. In fact, if the brake is large enough, it is surprising what an all-around improvement is made in the running of the hoist if a grease cup is applied to the brake shoes, so that some grease can be put on the face of the brake occasionally.

Since the maximum torque of an a.c. crane motor varies as the square of the voltage applied at the motor terminals, this voltage should be kept as near standard as possible. The writer has run against several cases where the longitudinal-travel motor would not pull the crane at certain positions on the runway; and on checking the machine over he found that the voltage was low on account of line resistance in the conductor rail. This drop in voltage so reduced the torque of the motor that the latter would not pull the load.

While a wound-rotor a.c. crane motor will run slow if enough resistance is inserted in the rotor circuit and the load is heavy enough, once it is up to speed it will not slow down again when the resistance is cut back into circuit. Therefore, the only way to slow the motor down is to shut the power off entirely and then turn on the power when the motor has dropped down to the desired speed. This is a serious disadvantage when handling light loads which have to be landed into place very slowly and carefully.

Where the headroom is limited a slower hoist speed has to be used or the available headroom cut down, as the limit switch will not stop the hoist as quickly on an a.c. crane as it will on a d.c. crane.

In case two of the phases get reversed anywhere on the line, the motors will reverse. This action, of course, cuts out the limit switch and also, in cases where a solenoid load brake is used, the lowering brake will cut in in the hoisting direction, with the chance of burning out the motor.

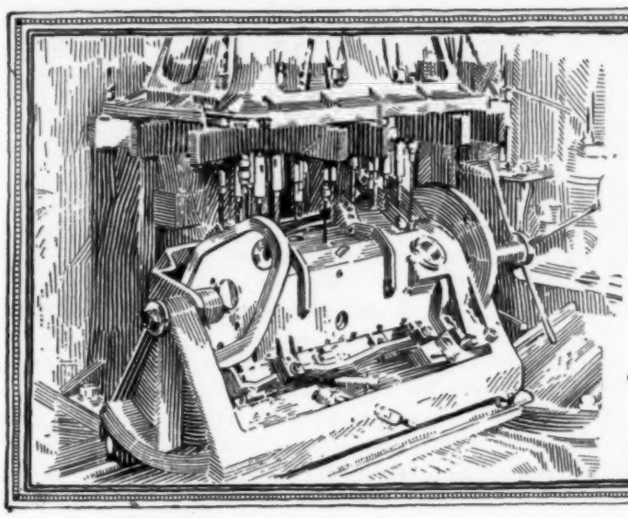
An alternating-current crane takes about 50 per cent more time to wire when being installed, thus increasing to first cost a corresponding amount. The running clearance is very small and the bearings have to be replaced oftener in an a.c. motor.

Changes Due to Heat Treatment

A recent communication from the Gage Steel Committee of the Bureau of Standards gives interesting data in regard to dimensional changes of steel during heat treatment. The steel in question is 100 point carbon with 1.4 per cent of chromium. Tests indicate that the method of annealing has an effect on dimensional changes in hardening.

The experiments also show that hollow cylinders expand more in diameter than solid cylinders and that with the same treatment the volume change is also somewhat greater. It was also found that, in spite of less change in both dimensions when oil was used for quenching than when using water, the volume change in the hollow specimen was practically the same in both cases.

Another experiment was made to show the effect of limiting the contact area between the piece being hardened and the quenching media. A pair of similar steel cylinders with holes 0.2 in. in diameter drilled longitudinally through the center, had disks ¼ in. thick fastened on each end by rods going through the holes. On quenching in water from a temperature of 1,508 deg. F. it was found that a circumferential crack formed on each end and that the end surfaces were decidedly concaved. This shows the nature of the expanding tendency in sections not near the ends of solid cylinders.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Use and importance of cutting lubricants—Proper application of coolant to tool and work—Lubricating milling cuts—Value of lubricants in thread cutting

SOME years ago, before the advent of high-speed steel, milling operations were much slower than they are at present, and the factor of lubrication of cutters was not considered as essential as it now is. Old-style milling machines were often provided with only a small can having a slender pipe extending from it to a point directly over the cutters. The oil was allowed to drip slowly over the cutters while the work was in process. No oil pump was provided for machines of this kind and the oil used was a total loss. The speeds and feeds used were necessarily slow in order to prevent the cutters from getting too hot and thus "drawing the temper."

At present, high-duty milling machines are provided with oil pumps and piping so arranged that an ample supply of lubricant can be directed where it will do the most good. There are special cases now and then which require an arrangement slightly different from that used normally, and when conditions of this kind are encountered it is necessary to pipe the lubricant in such a way that it will strike work and cutters as required.

Directing the Lubricant

It must be remembered that the functions of a lubricant are two-fold, and that it is necessary both to cool the cutters by carrying away the heat from them, and also to lubricate the work and reduce the friction. On certain kinds of work, if the supply of lubricant provided by the pump is copious, the direction of the stream to a point near where the cutting is being done, will allow the fluid to flow over the work and on to the cutters so that it will answer the purpose very well. If the lubricant flows down directly on the cutters and is not directed onto the work itself, the cutting action is impaired to some extent, although the benefit derived is of considerable importance.

In considering the matter, let us take the example shown at *A* in Fig. 570. Here a straddle milling operation is in process, and if the lubricant should be applied to the cutters *B* in the direction shown by the arrow *C*, a great part of the fluid would be thrown off by the revolution of the cutters so that only a film would remain on them at their points of contact with the work. If the lubricant is applied through pipe *D* between the cutters, as shown in the sectional view at *X*, the fluid will run over on both sides and a better lubricating effect will be obtained. If the pipe is arranged as shown at *E* the cooling compound will strike approximately where it is most needed, but it will be seen that the cutter action has a tendency to throw the fluid out and away from the points of contact with the work. There is, however, considerable value in an arrangement like this as far as

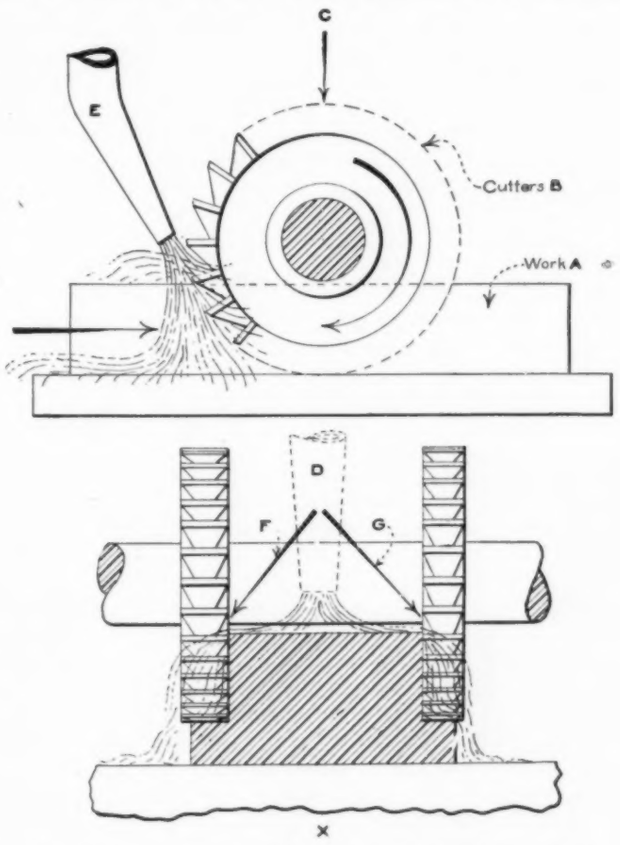


Fig. 570—Lubricant applied to a milling operation

For the authors' forthcoming book. All rights reserved.

the cooling of the cutters is concerned, and unless the depth of the cut and the feed used are both excessive, very satisfactory results can be obtained with this arrangement of piping.

In all probability, however, the best method of lubricating a straddle milling job like the one shown is by using a Y-pipe so made as to throw two good sized streams of compound in the direction indicated by the two arrows *F* and *G*. When this arrangement is used the fluid runs down the sides of the work and gets

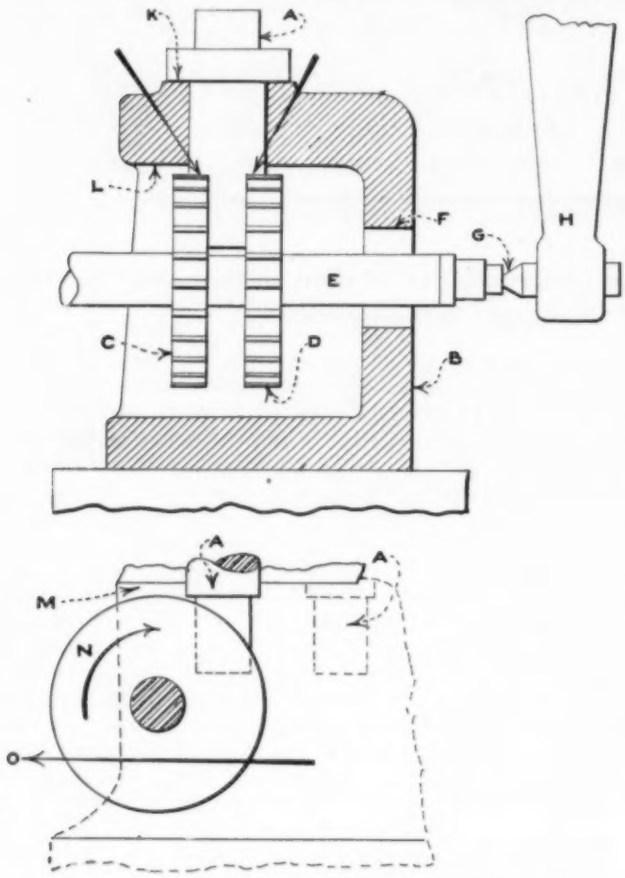


Fig. 571—Difficult problem in lubrication on milling machine

between the cutter teeth, so that its lubricating value is combined to the fullest extent with the cooling action. It may be necessary in special cases when very heavy cuts are being taken, to arrange special piping on the machine to obtain results like that indicated.

Some time ago a milling fixture was designed so that the work shown at *A* in Fig. 571 was held upside down in a special fixture *B* on a milling machine. The fixture was designed to hold a number of pieces of work and the cutters *C* and *D* were mounted on an arbor *E*, which extended through the slot *F* in the fixture. The outer end of the arbor was supported by the center *G* in the over-arm *H*. This method was selected in order to obtain correct location of the work from the shoulder *K*. The advantages of the fixture itself are of no particular interest at present, as something similar has been described in our articles on milling fixtures some months ago.

The problem of lubrication of the cutters, however, is very well worth considering for a moment, as it is evident that in a gang milling fixture like this one, it would be somewhat difficult to direct a lubricant to the proper points unless special arrangements were made. It must be remembered that the cutters are really working under the surface of the fixture *L*, and while at the beginning of the cut it would be comparatively easy to lubricate the cutters by directing a stream in the direction shown by the arrow *M*, it would not be so easy when the cutters had reached the other end of the fixture. The cutter travels in the direction shown by the arrow *N*, and the fixture moves as shown by arrow *O*. As there are a number of pieces *A* to be milled, some of them would be apt to suffer from poor lubrication with its attendant difficulties.

Several methods are possible in a case of this sort. The stream may be constricted so as to develop considerable pressure, and to enable a nozzle pointed in the direction *M* to carry the stream forward far enough to do the work. This is probably the easiest way to lubricate the work, yet it can also be done by cutting slots in the web *L* between the pieces *A*, so that the fluid will run down on the cutters as they progress from one piece to the other. There is still another way which could be used with the fixture, but this method is open to several objections. An oil pan can be set in the base of the fixture in such a position that the lower parts of the cutters travel continuously in a bath of oil and carry up with them a certain amount of oil as they come in contact with the work.

It will be seen from the foregoing examples that the matter of lubrication in milling operations is of sufficient interest to warrant careful consideration. It is our purpose to point out as far as possible to the tool engineer, the importance of each phase of the subject in order to make sure that he will realize and appreciate the thought necessary when designing tools and fixtures for different purposes. It is seldom that the tool designer considers lubrication of cutting tools to any great extent, yet the man who understands the matter thoroughly and who realizes its importance, will be a considerable distance in advance of his neighbor who is not so well posted.

Lubrication of Threads

In any kind of threaded work, the lubrication is a very important factor. The matter of cooling the tap, die, or threading tool is a secondary matter, as work of this kind is not run at high speed and the tools do not heat sufficiently to cause trouble. A rough thread, however, is very easily produced if the tools are not very keen and unless a lubricant of the proper kind is used and directed where it is needed.

Smooth threads are essential for good commercial work, but even under the best conditions the action of a threading tool has a tendency to tear the material to some extent. If you examine under a microscope, a piece of threaded work which is considered sufficiently good to pass a strict inspection, you will find that the sides of the thread appear to be torn more or less and, while they may be perfectly good from a commercial standpoint, the surface is really not as good as a piece of turned work would be. This is largely due to the shape of the threading tool and to the fact that the shearing action is not as pronounced as on some other kinds of work.

It is important, therefore, not only to provide an ample supply of lubricant, but the lubricant used should be of such a nature that it will produce the best results. Fig. 572 shows several diagrams illustrating the lubri-

cation of threads. In the example *A*, the work is a steel casting, in which the hole *B* is to be tapped. We can hardly imagine a simpler cutting proposition than the one shown here, and we give it only to emphasize the importance of lubrication. The first part of the thread is readily supplied with oil through the pipe *C*, and the lubricant enters the flutes of the tap *D* and flows easily through the work.

If we were to assume, however, that the hole is considerably longer than the example shown, the tap would

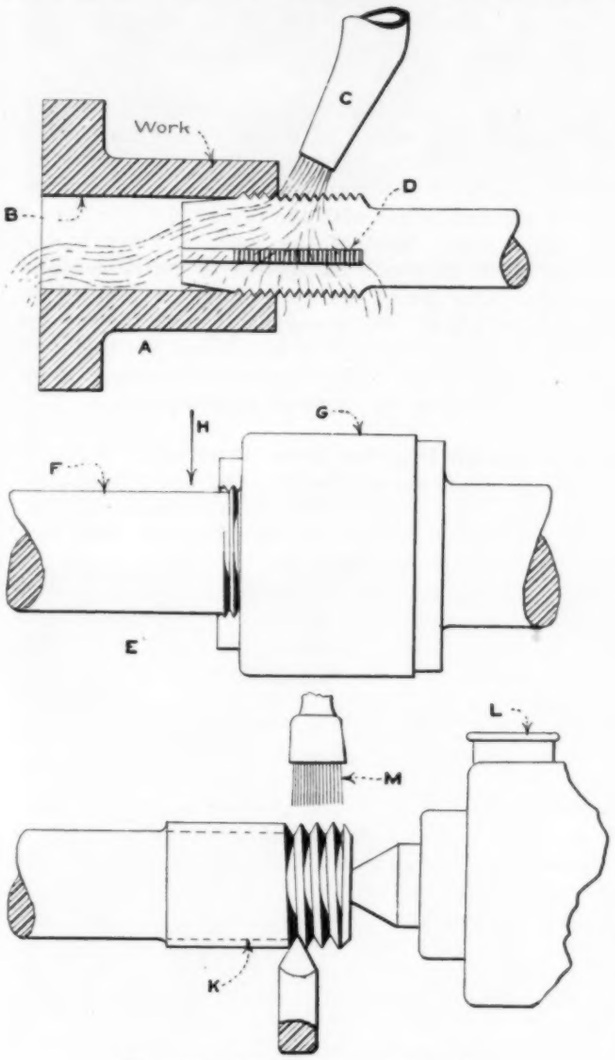


Fig. 572—Lubrication of threads

pass into the work far enough so that there would be little opportunity for the lubricant to flow freely, as the ends of the flutes would be inside the work, while the shank of the tap would not allow much space between it and the inside of the work. As a result, the further end of the hole would doubtless not show quite as smooth a thread as that at the outer end. If work is held in an upright position, the trouble would perhaps be greater, as the oil would flow out so much more rapidly. In the case of long holes which are to be tapped, it is advisable to make sure that the flutes of the tap are of sufficient length to allow the lubricant to flow freely to the full depth of the hole. Matters of this kind are often neglected, yet their importance can be readily seen.

In the example shown at *E* the bar *F* is being threaded by means of a die-head *G*. As this is common practice, the question will doubtless arise as to why any mention is made of the matter here; yet on certain kinds of work, particularly when the material is an alloy steel, the application of an ordinary mineral oil lubricant at the point indicated by the arrow *H* will not produce the best results. It must be remembered that we are particularly anxious to lubricate the thread thoroughly in order to obtain the best quality of work, and if a light oil is applied at *H*, it does not contain sufficient "body" to produce the desired effect. By mixing the light oil with a very heavy one and experimenting a little it will be found that the threads are considerably improved when the heavy lubricant is used. As a general thing, little attention is paid to matters of this kind in the shop, unless the workmen are properly instructed as to the importance of the quality of oil used.

Although we are dealing particularly with production tools, it will do no harm to mention a method used for lubricating threads when they are chased by a single-point tool on an engine lathe or on some other machine of a similar kind. The practice differs among expert workmen as to the kind of lubricant to use when cutting a particular job of threaded work, like that shown at *K*. We have known a number of first-class toolmakers who commonly use a mixture of white lead and linseed oil for nice thread cutting. There are some others who use vaseline, and still others who apply a special mixture of soft soap.

Speaking from our own experience, we believe that white lead and linseed oil makes as smooth a cutting compound for work of this kind as anything that can be obtained. The mixture may be held in a cup *L* on the tail-stock of the machine and applied to the thread with a stick or a small brush, as shown at *M*. No particular comment is necessary for this example and it is given only to supplement the information already supplied.

Alloy Steels in Locomotive Work

The influence of the automobile has extended to the railways, in regard to the selection of materials for locomotive parts. Many such parts are now being made from nickel, chromium and vanadium alloys, so as to secure strength with a reduction of weight in reciprocating parts, crankpins and similar members.

The use of these alloy steels brings new problems into the railroad shops, both as to the machining and heat treating of the parts, and makes it necessary for the foremen and other shop executives to keep posted on the latest developments along these lines.

In one experimental locomotive of the 4-8-2, or mountain type, built for the Union Pacific Railroad something over a year ago, the main and side rods, crankpins, piston rods and the driving and trailing axles were all made of carbon-vanadium steel. The piston rods and crankpins were hollow. This combination of hollow parts and alloy steel enabled a reduction of nearly 1,500 lb. in weight, and in places that count. Over 90 lb. was saved in the weight of one main rod, and over 40 lb. of this was in the reciprocating portion of the rod. Adding this to the 99 lb. saved in one piston rod, there was a reduction of over 140 lb. in reciprocating weight on each side.

All of which means that the modern railroad shop foreman must keep posted on the machining and heat treating of alloy steels.

Book Reviews

Cast-Iron Welding by the Oxy-Acetylene Process. Compiled by T. C. Fetherston, publicity department, Linde Air Products Co. Paper covers, 121 pages, 6x9 in., illustrated. Published by The Linde Air Products Co., New York, N. Y.

Here is a volume that aims at real education in welding practice and can be recommended on that account. It simply tells what has and can be done and advises on methods of procedure, and it must be said for it that it does not overstep itself and fall into an advertising talk for its publisher.

The welding of cast iron was not long ago considered to be impracticable. Due to experimentation and research, however, it has become fairly well established and is ever increasing in importance. The oxy-acetylene welding and cutting blowpipe appears well fitted to the work, as is brought out in the examples given. The book covers all phases of the work and is a complete text on the subject.

It is stated that the keynote of successful cast-iron welding is a thorough understanding of the necessity for adequate preheating, proper welding practices, and suitable annealing. In order that no factor in the subject may be omitted the book starts with chapters on the nature and properties of cast iron, the application of the welding process to cast iron, and the equipment used for the work. Details are then given as to the manner of preparation of the work for welding, preheating and the actual welding operation. Annealing, finishing and testing of welds come next. The manner of estimating welding costs is explained, and then some typical cast-iron welding jobs and practical problems on the subject are given.

Taking it all together the treatment is quite comprehensive, although concise. The plentiful sprinkling of illustrations adds considerable value. In addition, the value of the book for reference purposes is enhanced by the complete subdivision of the subject and by the marginal notes telling the contents of the various paragraphs.

The little volume adds quite materially to the existing fund of knowledge on the subject of welding cast iron, and should be of real practical value in the field. Its subject matter is cerainly up-to-date, authentic, and of value proven by actual experience.

Elements of Engineering Thermodynamics. By Prof. A. Moyer, Pennsylvania State College, Prof. James P. Calderwood, Kansas State Agricultural College and Dean Audrey A. Potter, Purdue University. Second edition. Published by John Wiley & Sons, Inc., New York. Cloth; 6x9 in., 224 pages; 75 illustrations; 10 tables and bibliography. Price $2.50.

As a thorough yet concise textbook on the principles of thermodynamics, the first edition received wide and favorable attention from teachers and practicing engineers. This revision embodies certain changes suggested by the users. The present discussion of heat cycles has awakened a general interest in thermodynamics among graduate engineers who have forgotten much of the subject. For such and others who have a reasonable mathematical equipment, including an elementary knowledge of calculus, this book offers a valuable opportunity for the review of fundamental principles without loss of time on non-essentials. Problems at the end of each chapter enhance the value of the book both for students and practicing engineers.

Power Plant Machinery, Vol. I, Mechanism of Steam Engines. By Walter H. James, Assistant Professor, and Myron W. Dole, Instructor, both at Massachusetts Institute of Technology. Second edition. Published by John Wiley & Sons, Inc., New York. Cloth; 6x9 in.; 227 pages; 224 illustrations. Price $3.

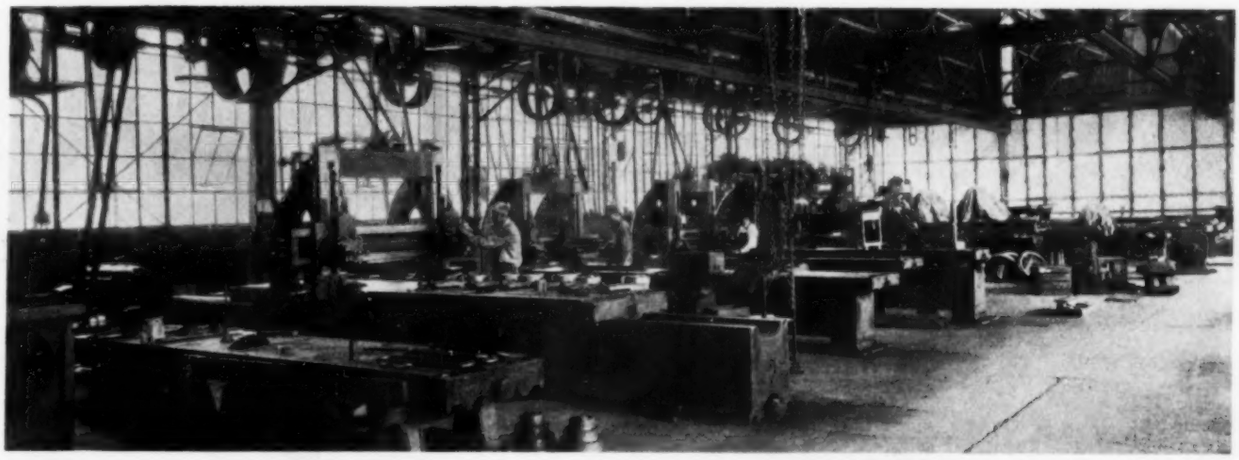
This book does not claim to be a general treatise on steam engines but merely a study of the kinematics or relative movements of the parts. It was written to meet the needs of students who have studied mechanism but are unfamiliar with the theory and practice of heat engineering. Most of the space is given to the standard valve diagrams as applied to stationary and locomotive valve gears, but a chapter is devoted to turbine valve gears. While excellently adapted for the teaching of applied kinematics in colleges the book will be of less value to operating engineers because it gives little space to the newer types of apparatus.

Machine Design Drawing Room Problems. By C. D. Albert, Professor of Machine Design, Cornell University. Cloth-board binding, 320 pages, 6x9 in., illustrated. Published by John Wiley & Sons, Inc., New York, N. Y. Price $3.

This excellent textbook on machine design is written for the classroom student, with the avowed purpose of conserving his time by deleting irrelevant and unimportant material. The arrangement follows the usual academic method of giving a broad discussion of the subject, and then completing the instruction by the use of several problems in the design of machines which are worked out in some detail. One good feature of the book is that unusual and theoretical considerations which affect the design of machines are brought in in their logical places in the problems, instead of being presented to the student as a mass of abstract material and information.

Each of the last six chapters, of which there are nine in all, presents a complete problem in the design of a machine. The machines considered include a pump, slide valve and gear, steam engine flywheel, punch and shear, a problem on balancing, and an upright drilling machine. All problems are illustrated by the use of photographic reproductions of machines and line drawings. Tables showing dimensions and properties of various materials and standard parts are interspersed throughout the text. Much useful material, such as machine part proportions and loading diagrams and formulas, is also tabulated, for ready reference.

The book not only fulfills its purpose as a medium by which the principles of machine design can be presented in the short time usually allowed by college curriculums for this subject, but also contains information which makes it of considerable value as a reference work. It will probably not build up the exceptional initiative and originality required in a practical machine designer, but it does furnish a groundwork in the fundamental principles of the art and their applications in actual machines.



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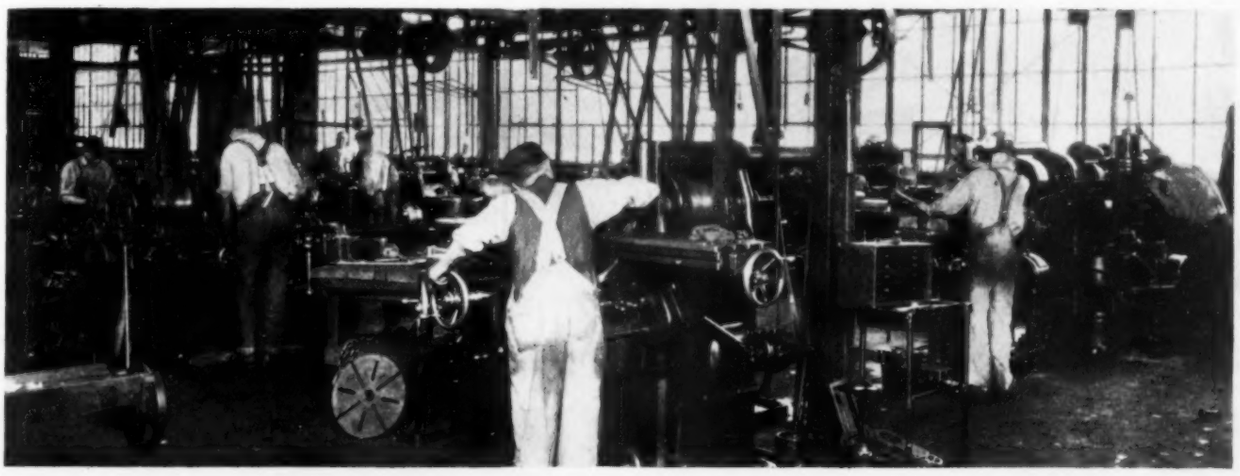
Where Machine Tools Are Made

The Ohio Machine Tool Company

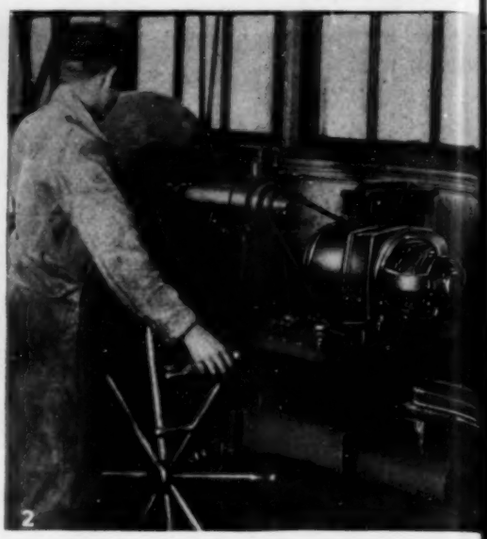
Kenton, Ohio

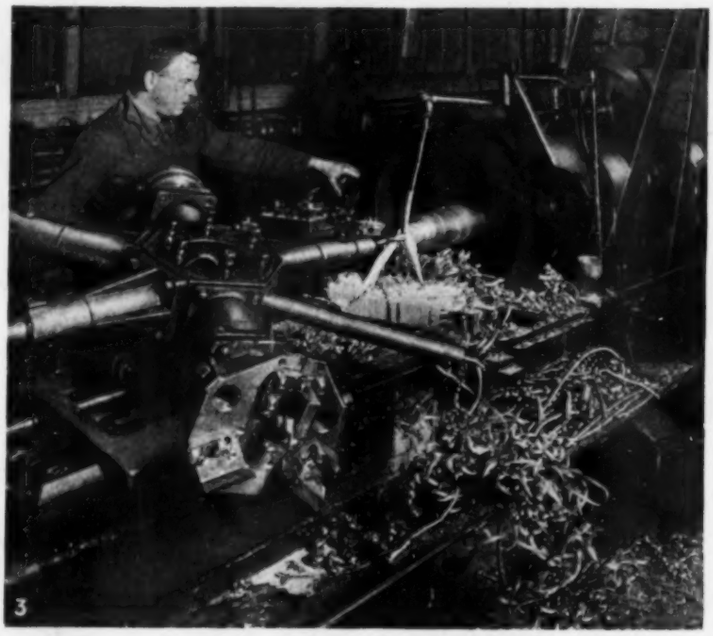
Original concern, Smith & Silk Co., founded 1887

A Section of the General Machining Department



Shaper Assembly, Showing Scraping, Fitting and Running-In Department





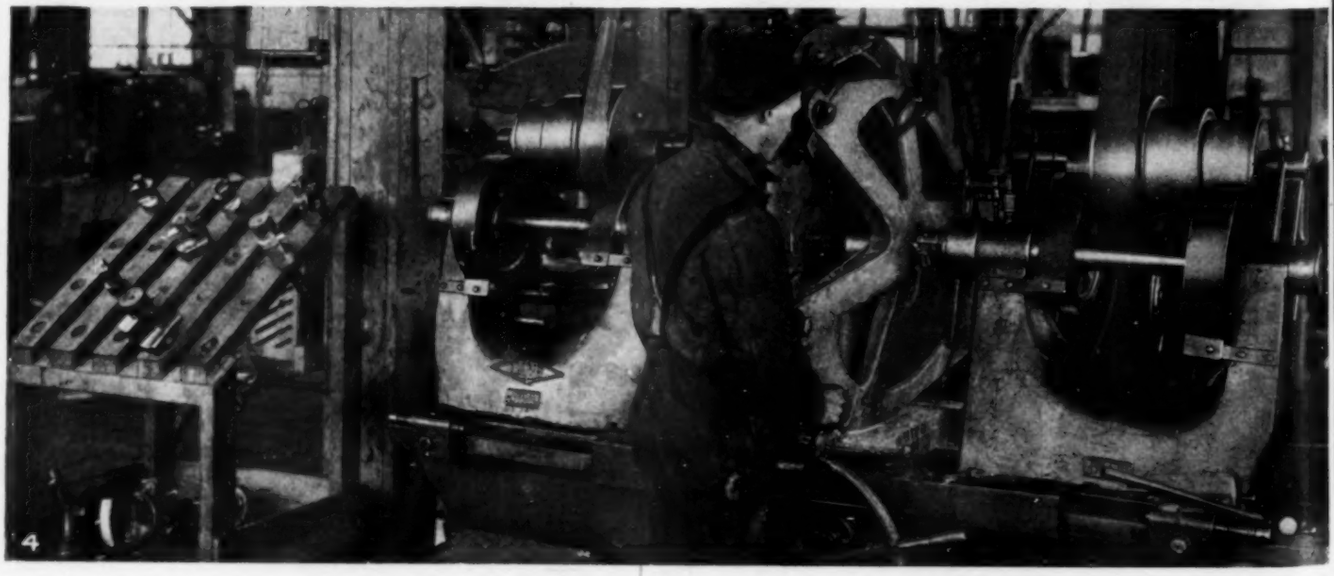
Pulley Blocks and

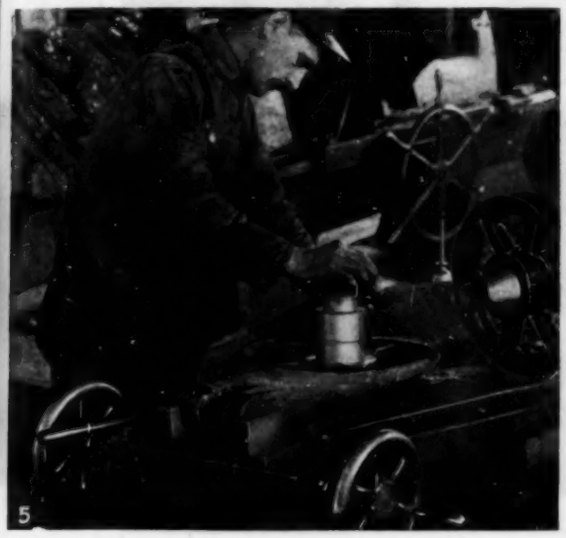
Fig. 1—Laboratory for determining chemical contents of furnace products

Fig. 2—Special machine for grinding hubs to receive the bushings. Material of all sheaves is manganese steel

Fig. 3—Making sheave pins or bearings on 24-in. Gisholt turret lathe

Photographs by courtesy of





How They Are Made

Fig. 4—Special machine for boring and facing pin connections. Machine will handle blocks from 6 to 42 in. in diameter

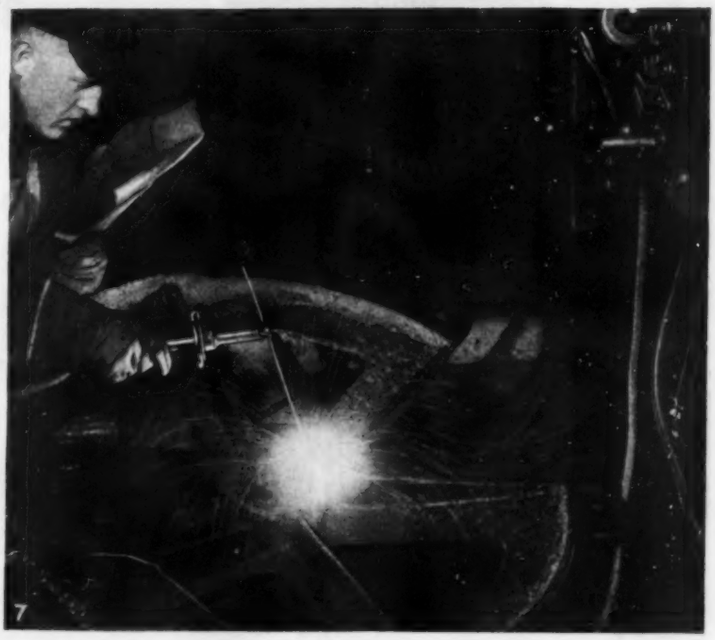
Fig. 5—Assembling blocks prior to placing in stock room

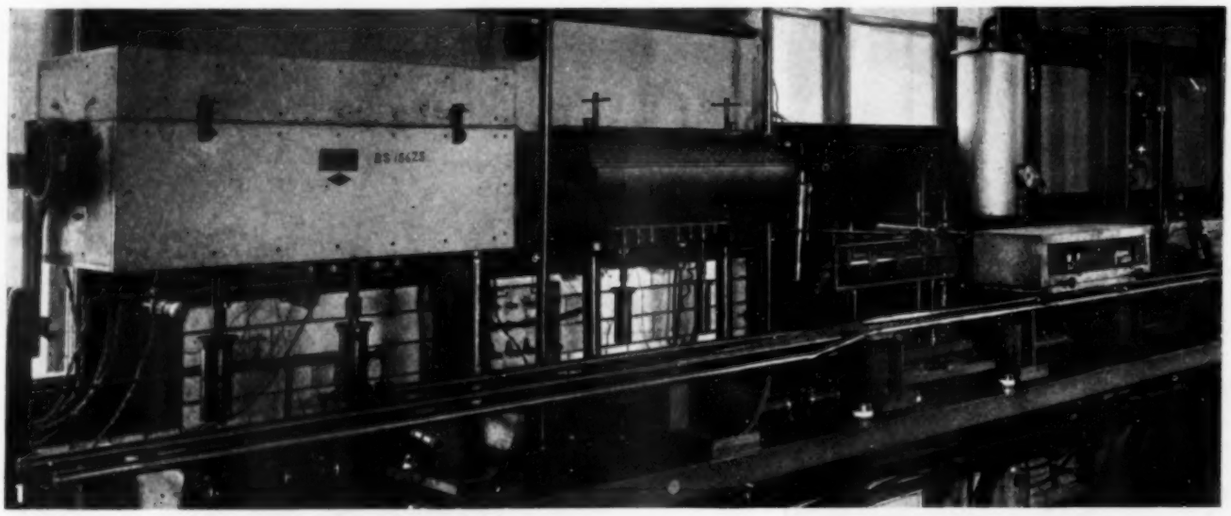
Fig. 6—Every part is inspected for quality and tolerance

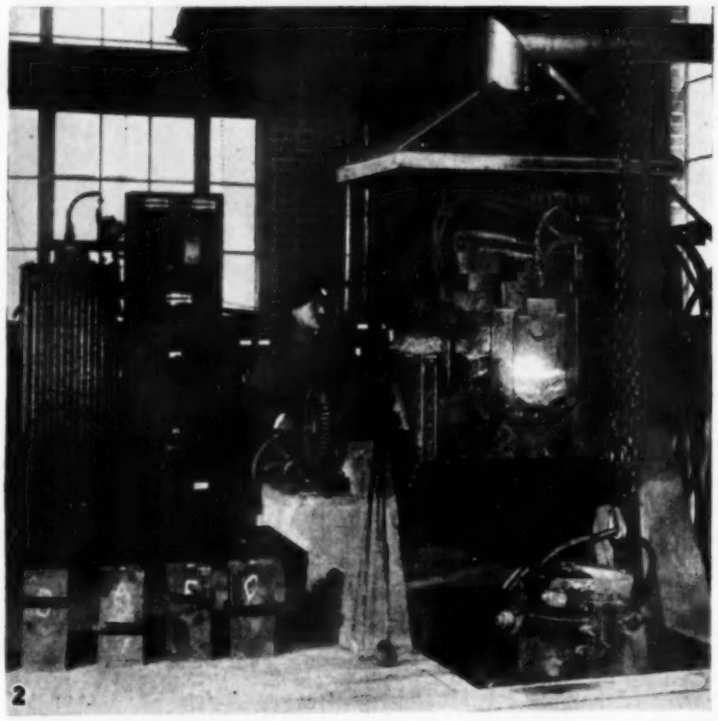
Fig. 7—Arc-welding a steel casting

Fig. 8—Southeast end of machine shop

Lamb Machine Co., Hoquiam, Wash.





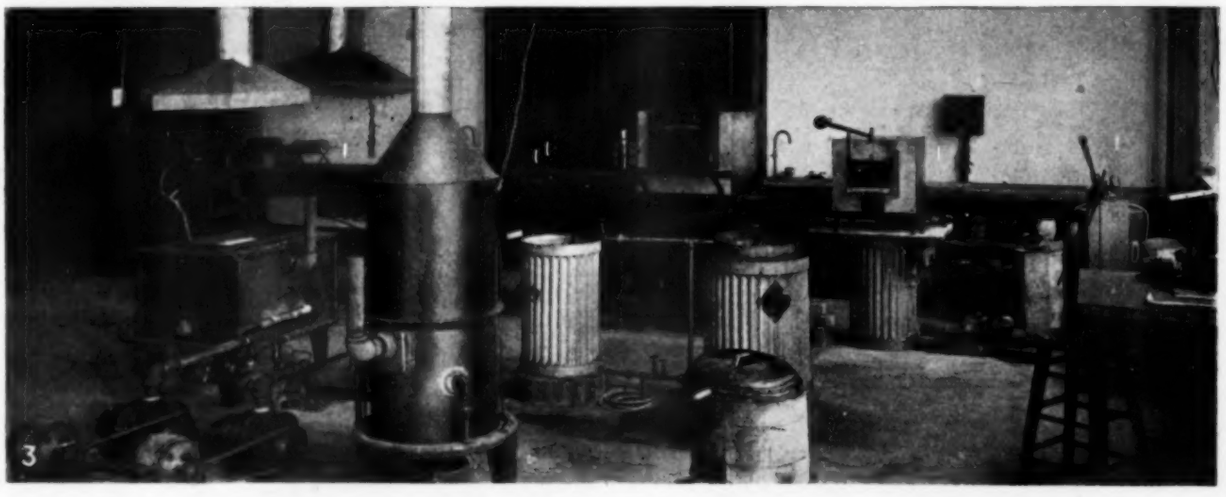


Heat-Treating at the Bureau of Standards Washington, D. C.

Fig. 1—Apparatus for measuring thermal expansion of metals

Fig. 2—Experimental electric furnace for metallurgical research

Fig. 3—Heat-treating plant in the meta lurgical division



Casting Crown Brasses and Hub Plates in Place—Discussion

By F. M. A'Hearn

Various methods of holding crown brasses—Lives of bearings and hub plates not the same—Why crown brassess get loose—Planing driving-box flanges

THE article by Fred H. Colvin, under the title given above, on page 479, Vol. 59, of the *American Machinist*, shows where a decided saving may be made in the machining operations connected with the finishing of a locomotive driving-box casting, and the renewal of the various parts that go to form the complete driving-box unit. It is apparent, however, if we may judge from the articles that appear from time to time in the pages of our mechanical publications, that there is a wide divergence in the methods used in the maintenance of locomotive driving-boxes in the various railway shops, and that a more uniform method would be advantageous, as some of the practices appear to be decidedly superior to others.

Pouring the crown brass and hub plate in a unit, as is done at the Scranton shops of the Delaware, Lackawanna & Western Railroad, was noted by the writer while passing through a shop on the New York Central line. Other roads deviate from this practice by machining the circular recess to receive the crown brass or bearing, and leave the hub face in the rough, the casting being of suitable shape to hold the liner poured upon it. Others still, machine both the crown-brass recess and the hub face, dovetailing the hub face, and in addition, drilling a number of holes into which the melted metal flows as an aid to securing the hub plate to the box. As a further contrast to the practice of pouring the hub plate and crown brass in place, is seen the design of the driving boxes used in the U. S. Railroad Administration locomotives, where the driving box is slotted to receive the fitted crown brass, the hub face of the box finished to a plane surface, and a brass hub or wearing plate secured by brass or copper patch bolts in a recess turned in the inner face of the driving wheel hub.

Practice of One Railroad

Another practice somewhat at variance with those already outlined, is that of a large railroad in finishing its driving boxes in a manner similar to that of the driving boxes used in the U. S. Railroad Administration locomotives, but which pour or cast a brass wearing plate on the hub of the driving wheel. This method necessitates placing the wheels with the axle in a vertical position and pouring the wearing plate on the hub of the wheel, reversing the position of the wheels to pour the hub of the opposite wheel. Provision for contraction is made by wrapping the axle next to the hub with several thicknesses of heavy paper which is burnt out by contact with molten metal. When poured, the wheels are transferred to a driving-wheel lathe, where the faces of the brass plates cast upon the hubs are machined to the proper dimensions. The last named method of applying hub plates involves the handling of heavy parts and the use of large machine tools, and appears to be the most expensive method of providing for hub wear. If there are any advantages in the method they are somewhat difficult for an outsider to discover. The type of driving boxes and hub plates used in the U. S. Railroad Administration locomotives differs little, if any, from those generally used for the past twenty-five years or more, and must have had certain merits in the minds of those designing the Administration locomotives or they would not have been used, as the locomotives ordered by the Administration, so far as the writer has observed, are remarkably well built and easily maintained.

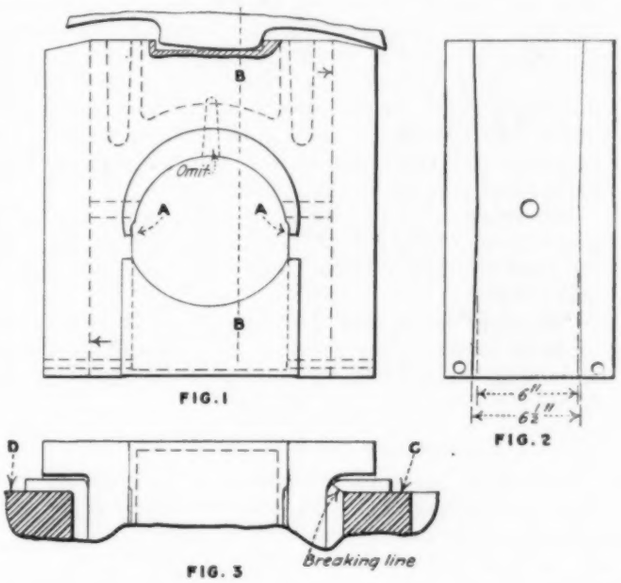


Fig. 1—Why crown brasses get loose. Fig. 2—How driving-box flanges should be planed. Fig. 3—Weak shoes and wedges and a remedy

Doubtless the relative amounts of hub-plate and crown-brass wear, vary with the different types of locomotives and track conditions over which they operate. On many types of locomotives, one crown brass will outwear three hub plates. When such is the case

the practice of pouring the hub plate and crown bearing as a unit presents some undesirable features. Whether brass is the best metal to be used as a hub plate, or whether a hard grade of babbitt is preferable, is a question that is not entirely agreed upon by motive-power officials, as tests have shown that under certain conditions babbitt is more satisfactory than brass.

Removable Crown Brasses

One objection to the slotted driving box having the turned and fitted crown brass, is the loosening of the crown brass. Removable crown brasses that may be taken from the boxes without dropping the wheels, have been used for several years, and in some cases have been entirely satisfactory in their performance. These brasses are a sliding fit in the driving boxes and are secured by the use of taper keys. There is little fear of turned and fitted crown brasses becoming loose when applied in the manner shown in Fig. 1 in the accompanying illustration. It will be noted that the brass is held by two turned plugs driven in through the shoe and wedge faces of the box into the crown brass. An early practice with this type of box was to drive a single plug through the top of the driving box into the center of the crown brass. With the use of grease cellars it was found that the plug would sometimes be forced out, due to the accumulation of grease below the plug, and would leave the crown brass unsecured in the box. This difficulty was later overcome by reaming the plug hole taper, with the large end next to the journal, and driving in a taper plug. This practice presented some undesirable features and was abandoned, the opening in the top of the driving box was plugged, and the sides of the box and crown brass drilled and plugged in the manner shown.

Referring to the rules of the Interstate Commerce Commission, Division of Locomotive Inspection, page 60, Rule No. 137, relative to driving boxes, we find the following:

"Driving boxes shall be maintained in a safe and suitable condition for service. Broken and loose bearings shall be renewed. Not more than one shim may be used between box and bearing."

General Understanding of the Rule

This rule is evidently understood by some to mean that the bearing shall be forced into the box at excessive pressure rather than that a moderate amount of force shall be used. It is not uncommon to see driving boxes spread at the bottom, or open end, ¼ in. or even more. This is a bad practice as it places the crown brass under a strain that will tend to crowd the sides against the journal when any relaxation of the spreading force occurs. It is frequently noted that when wheels are dropped on account of hot driving boxes, that the boxes have closed in at the bottom and that the crown brasses fit the journal more closely than when first applied. A very moderate amount of pressure should be applied in forcing a crown brass into a driving box. When cast-iron boxes were more commonly used, broken driving boxes would result from excessive pressure. The steel driving box does not fracture so readily, but the bad effects of excessive pressure are found in the subsequent distortion of both the box and the crown brass. Loose crown brasses may be traced to causes other than a light fit in the driving boxes. In too many cases an excessive clearance is bored at points *AA*, Fig. 1, as an aid to lubrication, the clearance sometimes extending 1½ in. or more above the centerline of the axle. When we consider that the piston thrust is often three times as great as the load imposed on the box by the spring rigging, we can readily see that a pound will rapidly develop in the bearing. Certain valve gear conditions also appear to have an influence in the wear at this point. The pound will tend to break or loosen the bearing, necessitating renewal.

There are other conditions that have a direct relation bearing upon the service period obtainable from crown brasses. Referring to Fig. 1, it will be noted that the driving-box yoke or equalizer is shown to bear at a point some distance away from the vertical centerline of the box, or on line *BB*. This condition rocks the driving box against the shoe or wedge, as the case may be, and wears a shoulder which prevents proper adjustment of the wedge, making a condition equally as bad as that caused by a poorly fitting bearing and having the tendency to break or loosen the crown brass. Another bad feature in conection with driving-box work, is that of planing the inner faces of the box flanges which bear against the shoe and wedge flanges, parallel the entire length of the box, instead of widening the top and bottom as shown in Fig. 2. A box having parallel flanges will break shoe and wedge flanges more frequently than one planed as shown.

Square Corners Cause Breakage

A contributary cause to flange breakage on shoes and wedges, and one readily avoided, is found in the practice as illustrated at *C* in Fig. 3, where the corners of the frame jaw, and the inner corners of the shoe and wedge, are square, while the inner corner of the driving box flange is provided with a large fillet. This necessitates cutting away the outer corner of the shoe or wedge, and leaving the least amount of metal at the point most subject to fracture. Rounding the corners of the frame jaw and reducing the fillet at the corner of the driving box flange, as shown at *D*, will leave additional metal inside and outside of the shoe and wedge flanges at the points most liable to fracture.

A careful study of locomotive driving boxes will show that while the locomotive is constantly being improved in many ways, the driving box shows but slight change from year to year, for boxes similar to those in use at present time were common to the motive power of thirty years ago. The driving box really forms the foundation of the locomotive, and without a good foundation the operation of the machine is as unsatisfactory as that of any other machine not properly supported. Short cuts and time saving appliances are valuable in making locomotive repairs. Time spent in determining what can be done to prolong the service life of the various parts of the locomotive, is time well spent.

Consideration must be given, not only to the use of conveyors for maximum or normal production but how they can be used when production is below normal The article on page 617, Vol. 59, of the *American Machinist* will be helpful in this respect. But the possible savings due to the use of conveyors are of sufficient importance to warrant the careful study of the problem by all production engineers and managers. It is one of the growing factors which affect production costs. The well-managed plant will be a leader instead of a follower when it comes to conveyors.

The Relation Between Inches and Millimeters—Discussion

By C. C. Stutz

IN HIS article on the above subject which appeared in the *American Machinist* on page 764, Vol. 59, H. W. Bearce of the Bureau of Standards, Washington, D. C., correctly states, "The result of a lack of agreement as to standard temperature is that accurately machined parts, when made to be correct at different temperatures, will not fit properly together even though of the same nominal dimensions."

To overcome this difficulty he suggests that two steps be agreed on. First, that a single fundamental relation between inches and millimeters be adopted, this relation to be 1 inch = 25.4 millimeters; second, that a single standard temperature be adopted at which industrial standards of length shall have their correct nominal dimensions, this temperature to be 20 deg. C. (68 deg. F.). Logically, however, it would appear that the second step should be taken first as a basis for the establishment of the proposed relation.

Any distance established in space, be it called a yard, a meter or by any other name, is unchangeable and not subject to or affected by temperature. But as soon as we represent this distance by a material bar, the bar is affected by temperature according to its nature, different materials having different coefficients of expansion. Therefore, such a bar can represent the absolute distance established in space only at a specific temperature. To establish a definite relation between the English yard bar with its sub-divisions and the French meter bar with its sub-divisions, standard respectively at different temperatures, we necessarily must take into consideration this question of temperature of the bars representing the units named.

Workrooms where men are engaged in physical labor are kept by preference closer to a temperature of 62 deg. F. than at 68 deg. F. The former is the temperature adopted in England as the one at which the Imperial yard is standard, but in this country we are using, more or less, the temperature of 68 deg. F. (20 deg. C.), following the example of the Bureau of Standards, which adopted this German standard. The difference of 6 deg. F. ($3\frac{1}{3}$ deg. C.), while regrettable, is small enough to be disregarded, as physical measuring instruments are used at temperatures at and between these figures. In France 0 deg. C. is insisted upon as the standard, but to use measuring tools in the shop on practical work at 0 deg. C. (32 deg. F.) is an impossibility, and proper allowance must be made when physical standards are correct only at that temperature.

Correct Relationship Factor Depends on Practice

As will be shown, English and French practices in applying the abstract lengths of established standards to physical measuring instruments are diametrically opposed. Thus, the use of an absolutely correct relationship factor would not result in the duplication of sizes in metal. The reasons for this difference will be apparent from the following brief analysis of English and French practice.

The fundamental English and American standard of length is the British Imperial yard which is standard at 62 deg. F. ($16\frac{2}{3}$ deg. C.), and incidentally, a study of existing laws shows the American and the English inch to be fundamental and identical. The present trend in this country for precision measuring instruments is to make them standard at 68 deg. F. (20 deg. C.). These instruments are made, therefore, so that their size, when at the temperature of 68 deg. F., is the same as the corresponding part of the British Imperial yard when it is at the temperature of 62 deg. F.

Arbitrary Expansion Coefficient Used in France

The fundamental metric standard of length is the meter bar, which is standard at 0 deg. C. (32 deg. F.). The general practice in metric countries for precision measuring instruments is to calibrate them at 20 deg. C. (68 deg. F.). This is close to the average temperature at which they are used, but their sizes are made such that, when the instruments are at 20 deg. C., they are not the same as the corresponding part of the standard meter when it is at 0 deg. C. Instead, an arbitrary coefficient of expansions of eleven millionths per unit of length per degree Centigrade is used. This means that if the material of which the instrument was made actually has this theoretical coefficient of expansion, when both the standard meter bar and the instrument were brought to the temperature of 0 deg. C. their sizes would be identical.

This arbitrary coefficient of expansion originated, as I understand it, with the Bureau International des Poids et Mesures, Sevres, France, and is used because of the difference in the actual coefficients of various materials. If all instruments of the various materials were made to agree with the standard meter at 0 deg. C., noticeable differences would result when they were used at the ordinary working temperature of about 20 deg. C. The practice adopted keeps the various working instruments uniform in size, for all practical purposes, at the ordinary temperatures at which they are used.

Let us assume that the exact relationship between the abstract lengths of inches and millimeters is such that one inch exactly equals 25.4 millimeters. For industrial purposes we are not interested in abstract lengths, but we are vitally concerned in having mating parts fit each other. The purpose of establishing a specified relationship is to assist in the development of international standards. Such standards to be workable must be such that parts made with these standards by either system of measurement must actually interchange with each other, otherwise they would be of no practical value.

What has been said above concerning the English and French practices may perhaps be further elucidated by means of an example. We will assume that a certain standard calls for a dimension of three inches. Using the factor of 25.4 this would correspond to a dimension of 76.2 mm. and, as far as abstract lengths are concerned, this dimension would be correct. If this dimension were developed in metal, however, the following differences would appear because of the different practices in applying the English and metric units to working measuring instruments.

The part made in England or America, when measured with English or American measuring instruments, would measure 3.000 in. at 20 deg. C., both the part itself and the measuring instrument being at that temperature, the inch being practically standard at that temperature and conforming to the length of the abstract inch in space. This same part measured in metric

countries with metric measuring instruments would measure 76.1832 mm. It is also true that if the part were made in metric countries with their metric measuring instruments, it would measure 76.200 mm., but when measured in England or America it would measure 3.00066 in. These variations come from the use of the arbitrary French co-efficient of expansion as noted above.

For scientific work abstract lengths are used, but in all industrial work the condition stated above prevails, and it will be seen that there exist, in metric countries, two meters. First, the scientific meter from which the interrelationship of yard and meter as definite lengths in space has been determined (39.370113 in. = 1 meter); and second, the industrial meter, which is larger than the scientific meter by 220 parts in a million.

This temperature question, in view of metric practice, is certainly vexatious due to the exacting demands now made by industry. These conditions were not foreseen by the scientists who evolved the metric system, but the question must now be met. All endeavors in that direction will have a sympathetic hearing and should be helped along, but to simply adopt, as suggested by Mr. Bearce, a single standard temperature will not solve the problem. Such procedure involves an agreement on an arbitrary coefficient of expansion and leaves the door open to the use of two different meters, even if his other suggestion be also accepted, that America and England consent to a change in the standard yard. The fact of the matter is that the meter as defined is an impractical unit while the yard, standard at a reasonable and above all practical temperature, answers admirably to the exacting requirements of industry.

To overcome an awkward situation, the suggestion might be made to shorten the standard meter bar, so that this bar at a temperature of 20 deg. C. (16⅔ deg. C.) would equal the definite distance in space now represented by the present bar, when at 0 deg. C. This would not change the meter itself, but would at once put on a solid footing the relation between inches and millimeters. Sixteen and two-thirds degrees Centigrade (62 deg. F.) is mentioned because the determination of this temperature presents certain specific advantages not obtainable when using 20 deg. C. (68 deg. F.).

In view of what has been said, it would appear necessary that the questions raised be made the subject of further study and conferences, with the thought of ironing out any differences of fact and interpretation. The position of the great English-speaking nations in the industrial field is such that they can but stand as a unit in matters of linear measurements. Furthermore, common sense would counsel us to keep what is helpful and discard what will only lead us into trouble and misunderstanding.

Give the Shop Man a Visit Through the Shop—Discussion

By A. W. Forbes
Forbes & Myers, Worcester, Mass.

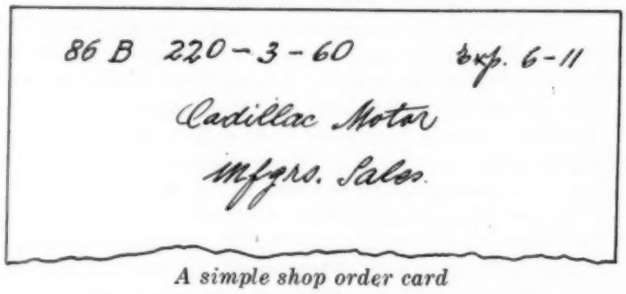
A NUMBER of articles have appeared in the *American Machinist* lately on the subject of giving the shop man a visit through the shop, the shop in which he works as well as other shops. We are too small to have any occasion to show our employees through our own shop, but this small size makes it of even greater advantage to make trips through other shops. We plan on making one such trip each year during working hours. If all wish to go, our shop is closed.

Last summer we visited the machine division of the Norton Company, one of the most up-to-date large machine shops in Worcester. The year before we saw the Worcester Electric Light Company's plant at a time when they had one of their large turbo-generators apart for repairs. Both these plants had machines similar to ours, but on a scale that made a great contrast.

We do not have as great attractions for the employees of other shops, though some occasionally visit us. This year we started a visitors' day, when our employees were asked to invite any friends they wished between 2 and 4 p.m., and to show them the work. The firm also sent out a number of invitations, and visitors came mostly in groups of two to four. They were taken directly into the shop and the one who had invited them left his work long enough to show them around, then returned to his work, leaving the visitors to look around by themselves as much as they desired. We found that with four times as many visitors as employees in the shop at once, there was no congestion. We intend to continue these visitors' days but have not decided how often.

In quite a different way our employees keep in touch with the business as a whole. It is a method that would be impossible where orders come in by the hundred, but where there are but few unfilled orders at any one time, it works well.

The accompanying illustration shows a standard shop order. Not much on it, but it gives complete information in such shape that it is understood by every one in the shop. It should be read, "One standard, model-86 tool grinder, bench type, for 220 volt, 3-phase, 60-cycle,



A simple shop order card

current, to be shipped by express on or before June 11 to the Cadillac Motor Car Co., the order being received through the Manufacturers Sales Co." The shop order card is 3½x5 in., the back side of half of a used time card. They are in four colors; red for orders direct from customers, green for stock parts, brown for experimental work and white for complete machines for stock.

A rack for these cards is placed next to the time clock and it has room for 68 cards, which is more than we ever have at one time. In addition to having these cards in plain view so that everyone in the shop knows just what is being done, I think it is also a distinct advantage to have the names of the customers and salesmen on the cards. It adds a certain amount of personal interest. Almost anyone would be more interested in hearing that Mr. Smith sold Mr. Jones another of a certain kind of machine, than simply that another should be made.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for.

Shouldered Washer Made by Coining

BY AMOS FERBER

The shouldered washer shown in the accompanying cut is made of cold drawing steel ¼ in. thick, in three simple press operations.

The plain washer shown at the left is produced by

Coining a shouldered washer

gang tools in the usual manner, each stroke of the press piercing the holes for a number of washers which are then blanked out by the succeeding stroke, so that the full number of pieces corresponding to the tools is produced by the press at each stroke after the first, or piercing operation.

The second operation is performed in a 1,000-ton coining press with but one washer in the tools. The lower die has a plug to fit the hole in the plain washer and an annular recess ⅛ in. deep, and of the same diameter as the shoulder of the washer surrounding the plug. The punch presents a plane surface having a hole in the center to fit over the plug in the die.

The hole in the plain washer is of the same diameter as the hole in the finished piece. The outside diameter of the plain washer is made approximately equal to the mean of the two diameters of the finished piece. The movement of the press brings the punch down to a position ⅛ in. above the plane surface of the die and the ¼-in. metal, after filling the annular recess in the latter, has no option but to spread out in the ⅛-in. space between the tools.

The coining operation produces a washer that is good enough for most purposes, as the pieces are of fairly uniform diameter and have smooth, though somewhat rounded edges. As the washers are to be used for a purpose that demands exact uniformity of diameter and a square edge, they are subjected to a later trimming operation that leaves them as shown at the right.

The washers are made by the Worcester Pressed Steel Co., Worcester, Mass., in which shop the tools were also designed and made.

Two Methods of Machining Hubs

BY CHESTER H. FRANKLIN

The accompanying illustrations, both from the shop of the Sheldon Axle & Spring Co., Wilkes-Barre, Pa., show two distinct methods of machining wheel hubs for motor trucks. The first method, shown in Fig. 1, is a hang-over from the older days of making equipment for horse-drawn vehicles, while the second method may be called a development of the motor age.

The first method, however, is interesting in presenting an uncommon way of guiding the large box tool. The hub to be turned is carried on a long mandrel with the end projecting, as at *A*, Fig. 1. This end fits a bushing in the shank of the box milling tool, and so keeps the cutting tools concentric with the work on the mandrel.

In addition to this, the block *B* acts as a guide and support for the heavy box tool, which is provided with a steel wearing strip at *C*. With this combination, it is comparatively easy to turn the outside of the hub concentric with the bore.

Fig. 2 requires little explanation, as it shows what is practically the standard tool equipment and method used on the Potter & Johnston semi-automatic.

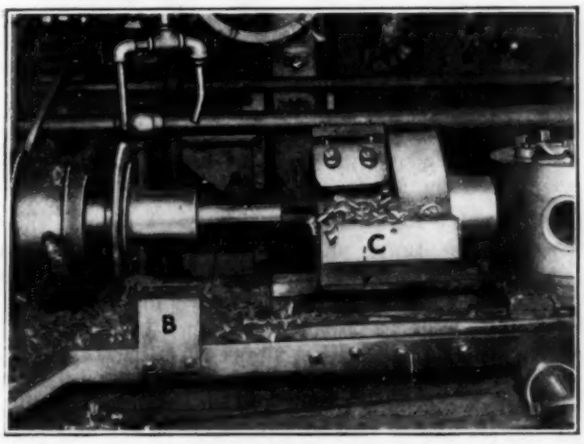


Fig. 1—Turning truck hubs on a large turret lathe.

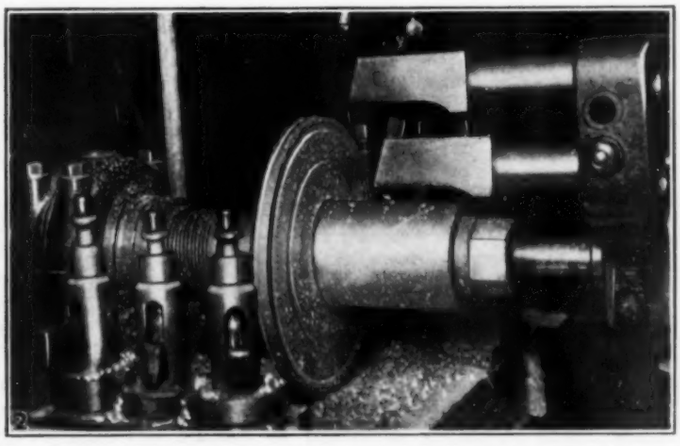
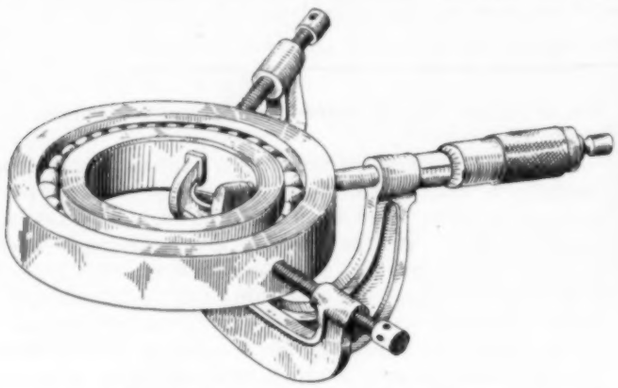


Fig. 2—The modern method of handling the same job

Measuring the Wear in a Ball Bearing

By Joe V. Romig

In overhauling machinery, particularly automobiles, it is often desirable to know just how badly worn a ball bearing has become in service, and not every mechanic knows how to make a comprehensive inspection that



Checking a ball bearing for wear

will give him exact knowledge of the conditions. The following described method is simple, easy to apply, and will show the amount of wear to a nicety.

Clamp the inner and outer rings together as shown in the sketch, using two small C-clamps and tightening them sufficiently to bring the parts of the bearing into firm contact but not tight enough to spring the rings, and measure over both rings, as indicated, with a micrometer. Next, without disturbing the clamps, take a measurement in the same way over a point diametrically opposite to the first.

The difference between the two measurements will be equal to twice the amount of wear that has taken place since the bearing was new.

Using a Bolt Cutter for Riveting

By Hamilton Casey

In one of the smaller automobile plants a number of soft rivets were used to join aluminum sheets and steel strips to form the engine hood. The number of parts produced was not large enough to warrant the purchase

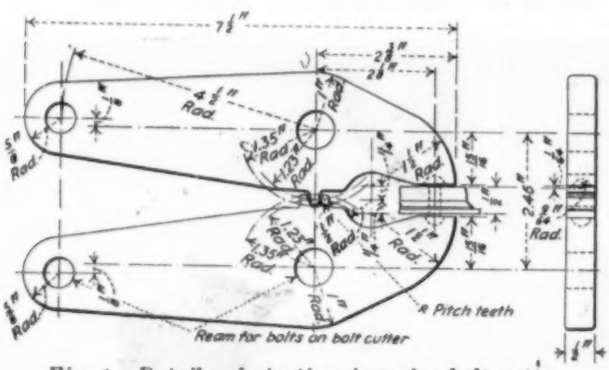


Fig. 1—Details of riveting jaws for bolt cutter

of any very elaborate equipment and the shape of the piece made it rather awkward to handle. Ordinary hand riveting was slow and engaged too many men.

Fig. 2—Riveting bolt cutter in use

Finally some one hit upon the idea of using a bolt cutter with special jaws for the job. The jaws were made according to the details shown in Fig. 1.

With the completed tool employed as illustrated in Fig. 2 it was found that one man could easily handle the required output.

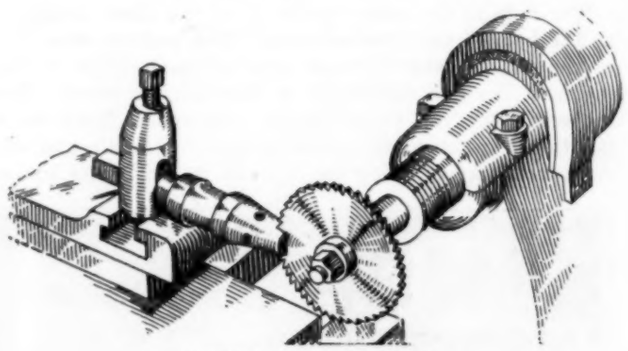
Slitting Feed Fingers in a Lathe

By Fred W. Mansey

I have charge of a department of automatic screw-machines and it is a part of my duties to make minor tools and replacements. For this purpose I have a lathe and a drill-press, but no milling machine.

One of the jobs that falls to my lot is making feed fingers for the machines, which job is all lathe work up to the point of sawing the slots; when a milling machine becomes a virtual necessity.

I had been watching my chances to use the toolroom



A slitting saw in a lathe

milling machine for this part of the work, but as these chances became fewer and farther between I was impelled to devise some means of slitting the fingers in my own department, and the rig shown in the sketch is the result.

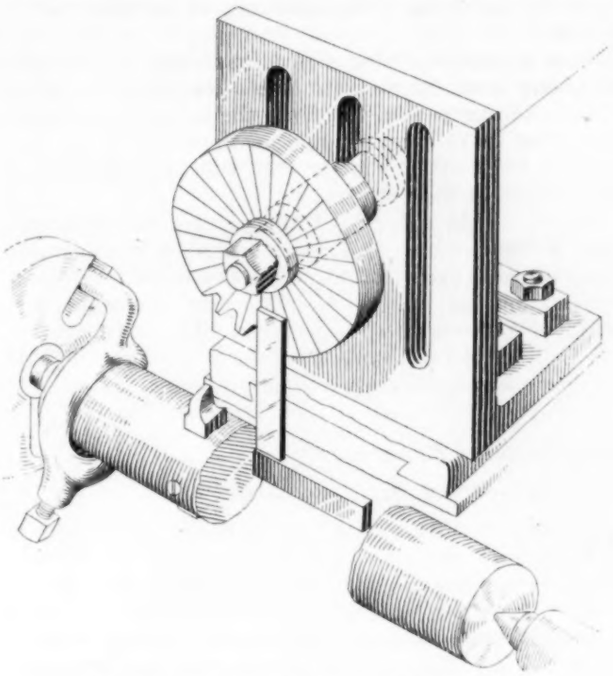
A short stud arbor with a shank to fit the taper hole in the lathe spindle takes the slitting saw, which is held by a right-hand nut and washer in the usual way. Small fingers can be held to advantage in the tool post; larger ones require a V-block and improvised clamp.

Cutting a Gear Without Proper Equipment

By John Mulquin
Luton, England

One of the questions put by the board of examiners to a friend of mine who was seeking an engineer's position in the Navy was how to cut a spur gear upon an ordinary engine lathe without the use of any special equipment or the aid of any instrument of precision—such as vernier depth gage, sinebar, etc.—and using only such tools and accessories as would commonly be found in the kit of the average turner.

One of the most common solutions offered for this problem is to mount upon the first spindle of the change train, a gear having the same number of teeth as required in the new gear and index by means of this gear in the same manner as is used in cutting multi-start threads; the method of cutting being to place a formed tool in the toolholder of the lathe with the face at a right angle to the travel of the carriage and "pump" the latter back and forth by hand. This method demands an extraordinary amount of skill and patience as well as almost unlimited time. I recently suggested the following method of doing the job, and, though I do not warrant it to produce a mechanically perfect gear, it has the advantage of requiring very much less labor and a comparatively small amount of time.



Emergency method of cutting a gear

Let us assume for purpose of explanation a 27-tooth, 8-d.p. gear. First we find the diameter of the pitch circle (in this case 3⅜ in.) and with an ordinary pair of dividers we scribe this circle on the face (side) of the gear blank. Then with the same dividers, and getting the correct distance from our table of chords, we lay off the 27 divisions representing the teeth, and through each point we scribe a radial line across the face of the blank.

Besides the lathe, the tools now needed will be a try-square; an ordinary boring bar fitted with a fly-tool to cut the shape of the tooth-space and with a carrier, or dog, to rotate the bar; an angle plate with an elongated slot in one face and holes in the other face to correspond to the position of the bolts in the toolblock of the lathe; and a stud by which the gear blank may be attached to the vertical face of the angle plate.

The angle plate is bolted to the toolblock and squared up both ways. The gear blank is then mounted on the vertical face of the plate by means of the stud and one of the radial lines is adjusted centrally (exactly vertical) by means of the try-square before finally clamping the gear tight. The fly cutter is then brought directly under the center of the gear and adjusted for depth of cut by tapping the stud up or down in the slot of the angle plate.

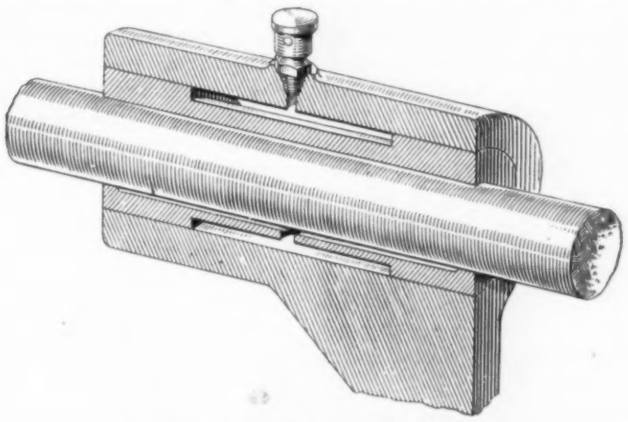
The bar is rotated by a carrier in the usual manner and the slow cross feed of the lathe can be applied to the cutting. To index for succeeding teeth the clamping nut is loosened sufficiently to allow the gear to be moved and the radial lines brought successively to the correct position by means of the try-square.

A Good Self-Oiling Bushing

By Joe V. Romig

When trouble has been experienced from worn-out bearings, and it is necessary to rebush them or to rebore and bush them, if no bushing had previously been used, a good way to make the bushing is as shown in the sketch.

After turning the outside diameter of the bushing to fit the housing, hanger or whatever it is to go into,



Bearing bushing with oil chamber

reduce it about ¼ in. or more over about one quarter of its length either way from the middle, leaving the remaining quarter length at each end of full size.

Drill an oil hole in one side and cut oil channels to within ¼ in. of each end. When finally putting the bushing in place, if the outer member be stationary, be sure and have the oil hole at the bottom.

The central reduction will leave an annular oil chamber that may be filled through the oil cup at the top, forming a reservoir from which the oil will flow up through the hole at the bottom of the bushing, and through the channels to the ends of the bearing.

A bearing fitted with a bushing as described above will give no trouble and will run for a long time without any attention, other than filling the oil cup at stated periods.

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KENNETH H. CONDIT AND FRED H. COLVIN
Editors

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Combatting the Noisy Minority

IT IS a regrettable but actual fact that people who do the most talking often win out at the expense of the less vocal do-ers. Such being the case, isn't it the part of wisdom for the latter important class in the community to find some means of expressing itself?

The need for presenting the side of business and industry is brought sharply to mind by a statement recently made at a leading college for women. The list of speeches made up by an undergraduate society contained the names of many of the most vociferous of the "progressive" group but almost none from the ranks of successful business men or manufacturers. When the president of the society was questioned on the lack of balance in her program she replied that it was impossible to persuade the business men to make addresses while the socialist-communist advocates jumped at the chance.

On top of this comes a broadside from an organization in Washington calling itself the Peoples' Reconstruction League. It claims that "Secretary Mellon plans to saddle the war debt on the farmers and wage earners . . . instead of taxing profiteers justly." Such reasoning, if it may be dignified by such a name, cannot but appeal to the malcontents, and may possibly have some effect on a certain type of Congressman.

The statements of men of this type who make up the noisy minority may sound ridiculous to those who understand basic conditions but to those who are not so fortunate they are very plausible. Some means of combatting them must be found and it is up to business men to make some sacrifices of time and convenience to accomplish this end.

Progress in Solving The Second Hand Problem

ONE of the well known ways to attack the problem of second hand automobiles, machine tools or almost any other commodity is to introduce new models of so radical a nature that existing ones become obsolete. No one who visited the recent New York automobile show can doubt that the motor car designers have taken long steps in this direction.

Front wheel brakes and balloon tires have such a profound effect on the operation of any automobile that the very large part of the population which insist on having the latest thing will want to trade in their present cars immediately. In addition the more conservative owners, once they have ridden in a car so equipped, will investigate the possibilities of bringing their present cars up to date. When they measure the cost of the change against the cost of a new car many of them will decide to abandon the old one.

There is a temptation to compare such developments in automobiles with the changing styles in women's clothing and also in men's clothing for the matter of that. Most people know that such changes are deliberately engineered by manufacturers and designers in order to insure the purchase of new equipment each year whether the old is worn out or not. But in the case we have mentioned such a comparison would not be fair because dress style changes can hardly be ranked as improvements in the majority of cases while it is very seldom that changes in mechanisms do not improve either the operation of the machine, or its appearance, or both.

From a merchandising viewpoint it may be well for machinery manufacturers to take a leaf from the book of the clothing people. If from the mechanical standpoint they make every change an improvement no one can find fault with them for they will have rendered a real service to the community.

Unfortunately changes of this nature in highly developed modern machines necessitate a considerable expenditure of gray matter. Such an expenditure rarely comes from the type of designer who copies the best points of his competitor's machines. The designer with the really creative imagination however, delights in just this form of mental exercise. More power to him!

The Amazing Progress of German Standardization

WHAT IS THE significance of the strenuous efforts German engineers are making to complete their program of engineering and industrial standardization? If we are not very much mistaken it is high time American industry took careful note of what is being done. There is no doubt that most German industries are in a bad way and that their engineering bodies are very short of funds. Nevertheless each month sees a respectable volume of new standards printed and distributed.

Two of the most recent ones have just been sent us by the secretary of the American Engineering Standards Committee. One contains standards for mechanical drawings, the other standards for power transmission and they are both real jobs.

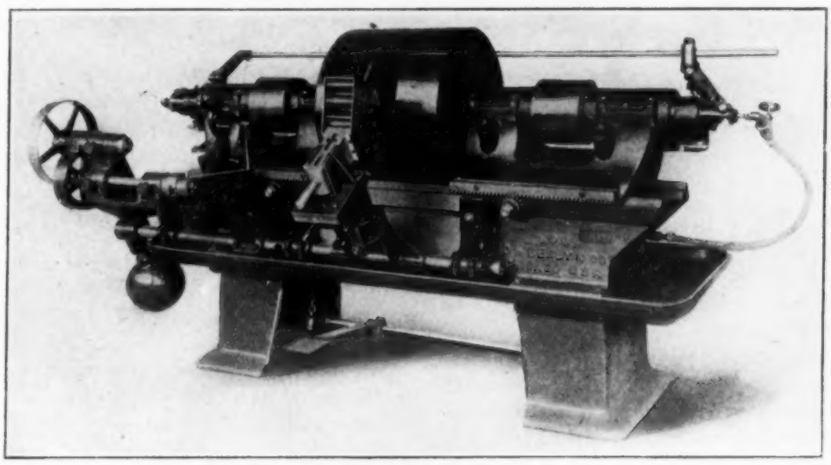
Perhaps an answer to the question propounded above may be found in the fact that some of these standard booklets, the Germans call them "Dinbücher," have been translated into Spanish for South American consumption. If the engineers of Latin America accept them because they are the only standards extant, American manufacturers are suddenly going to discover that their product must be made to German standard specifications if they want any business from South America.

Standardizing bodies in the United States are working hard but they are few in number and their support is very weak. Unaided they can hardly succeed in a job that demands co-operation from everybody concerned. Are you doing anything to help them?

Shop Equipment News

Besly Coil Spring Grinding Machine

A machine designed for the purpose of grinding the ends of coil springs rapidly and accurately has recently been developed by Charles H. Besly & Co., 118 N. Clinton St., Chicago, Ill., and is now being marketed. The machine, which is shown in the accompanying illustration, consists primarily of two heads mounted on V-ways, each head carrying a spindle with a grinding wheel attached to the inner end. The ways are carefully machined and the heads can be adjusted and clamped at any point to accommodate springs of any length up to 15 inches.



Besly Coil Spring Grinding Machine

The springs are placed in a detachable work fixture that is held in a power-driven oscillating or rocking device located on a rocker shaft at the front of the machine. The movement of this rocker shaft is obtained through a connecting rod, attached to a crank bearing on the end of a geared-head driving shaft. A hook-up lever makes it possible to instantly detach the connecting rod from the rocker shaft arm so that the work can be changed without stopping the machine.

The detachable fixture holds 18 springs and the use of two fixtures makes it possible to reload one fixture while the work is in process of grinding in the other on the machine. The fixtures can be changed almost instantly. The weight of the fixture is balanced by a counterweight on the end of the rocker shaft.

The spindles are fully enclosed and are of the sliding type, the operation of a foot lever causing the wheels to move apart so that the work can pass to its grinding position. Upon releasing the lever, the wheels close in on the work and grind the ends off to the length determined by stops on the spindles. The stops are fitted with micrometer dials so that the wheels can be adjusted accurately and easily by hand. The wheels shown in the illustration are 18x4x 9 in., but the same type of machine can be furnished in a larger size, using wheels 24x4x12 inches.

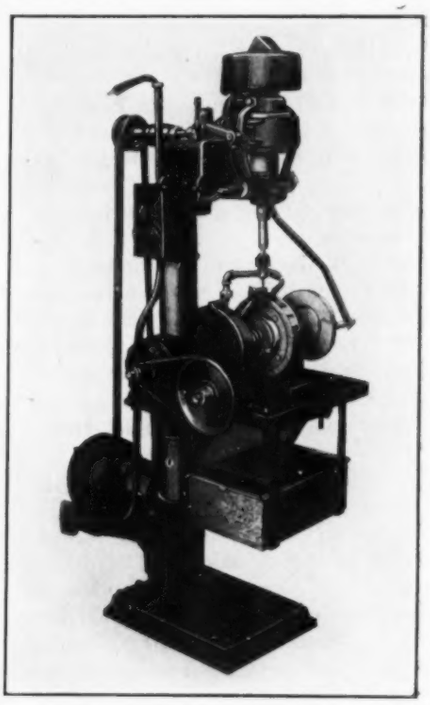
An adjustable, rigid-type, lubricated, wheel truing attachment is fitted to the base of the machine. This device can be quickly swung into position through an opening made by removing a detachable leaf at the rear of the dust hood. Coolant flows over the work from pipes that connect with the hollow machine spindles. The machine is built for either belt or motor drive. The belt-driven machine is shown in the illustration, each spindle being provided with a wide-faced belt pulley located between the spindle bearings.

Gaterman Single Spindle Automatic Tapping Machine

The pneumatic oscillating tapping machine manufactured by the W. Gaterman Manufacturing Co., Manitowoc, Wis., and described on page 496, Vol. 59, of the *American Machinist*, is now being marketed with an attachment for automatic operation.

A rotating fixture is attached to the table as shown in the accompanying illustration, and is automatically indexed. The chucking portions of the fixture are machined to conform to the shape of the pieces.

The spindle feeds down and returns automatically and the operator has only to load the pieces into the fixture, as they are ejected automatically. It is stated that the pneumatic oscillating feature of the machine permits the use of plug taps, and allows them to be operated at high speed without danger of breaking or stripping the threads.



Gaterman Automatic Tapping Machine

Marquette Pneumatic Double-Draw Die Cushions

The double-draw die cushions shown in the accompanying illustrations are recent additions to the line of pneumatic die cushions manufactured by the Marquette Tool & Manufacturing Co., 319 West Ohio St., Chicago, Ill. Pneumatic die cushions are used to provide uniform pressure throughout the drawing stroke, obviating the variation in pressure occasioned by the use of springs or rubbers.

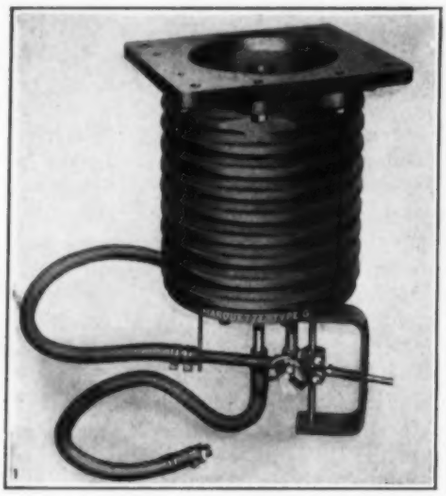


Fig. 1—Marquette Type G Double-Draw Die Cushion. Fig. 2—Type H Double-Draw Cushion

The double-draw cushions also make it possible to perform two operations at one stroke of the press. The type G cushion illustrated in Fig. 1 is designed for use on single-acting presses, and permits draw and redraw operations at a single stroke, using special dies.

The cushion is attached to the bolster or to the bed of the press, as required, and the air supply is connected to the cylinders. The device consists of an inner cylinder in which the piston for the inside draw-ring moves, and an outer annular cylinder whose piston operates the outside draw-ring. It is recommended that the cylinders be connected to independent air tanks so that the desired pressure can be applied to each cylinder.

It is said that one operator using double-draw dies and cushions will produce the same amount as two operators with the usual equipment. The cost of double draw dies is the same as a first operation and a redraw die and, since one press does the work of two, a considerable saving is claimed on equipment, as well as on the production cost.

Each installation requires special treatment unless the work has been formerly done with double-draw equipment, and this service is provided. The detailed installation and operation of the dies and cushions depends on the work to be done and the proportions of the press to be used.

The type H double-draw cushion, illustrated in Fig. 2, is for use with a double-action press and will make the first draw and one redraw at one stroke of the press. The cylinder is bolted to the plunger slide and a secondary draw-ring for making the redraw is attached to a large boss on the piston. The piston slides over a hollow tube in the center of the cylinder, through which the punch operates. The blank holder slide functions in the usual way. The air pressure pipe is attached at the opening near the top of the cylinder.

Tolhurst Friction Clutch Pulleys

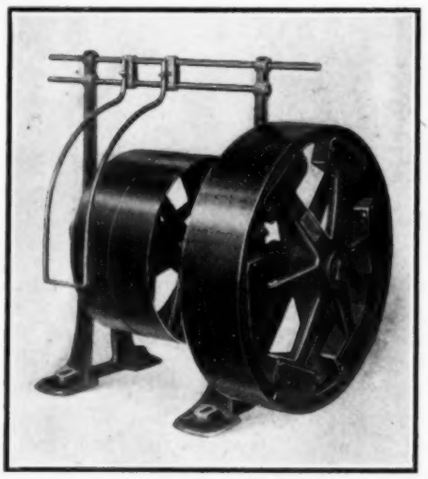
The Tolhurst Machine Works, Troy, N. Y., has recently developed some friction clutch pulleys for application to its centrifugal extractors, chip wringers and metal dryers. These pulleys are made for both countershaft and individual motor drives, the former type being shown in the accompanying illustration.

The frictional driving force is automatically applied through the centrifugal action of the driving portion of the clutch, and no springs or other mechanical devices are required. Due to the high inertia of the machines for which the clutches are intended, a tremendous amount of power would be required to start them instantaneously, and these clutches are accordingly arranged to apply a reasonable and predetermined amount of power to the machines over the short space of time necessary to bring the rotating parts to full speed. Slow or rapid acceleration may be obtained through a simple adjustment.

In operating the apparatus shown in the illustration, the belt is shifted directly from the loose to the tight pulley and the latter, with the clutch spider to which it is attached immediately revolves at full speed. A series of blocks are mounted in radial slots in the spider and are caused to bear against the inside of the clutch drum by the centrifugal force developed at the high speed. The friction between the blocks and the clutch drum or driving pulley brings the pulley and its load quickly and smoothly to full speed.

Slippage between the blocks and the drum ceases at full speed and the apparatus then functions as a solid pulley. Belt slippage at starting with its attendant difficulties is practically eliminated.

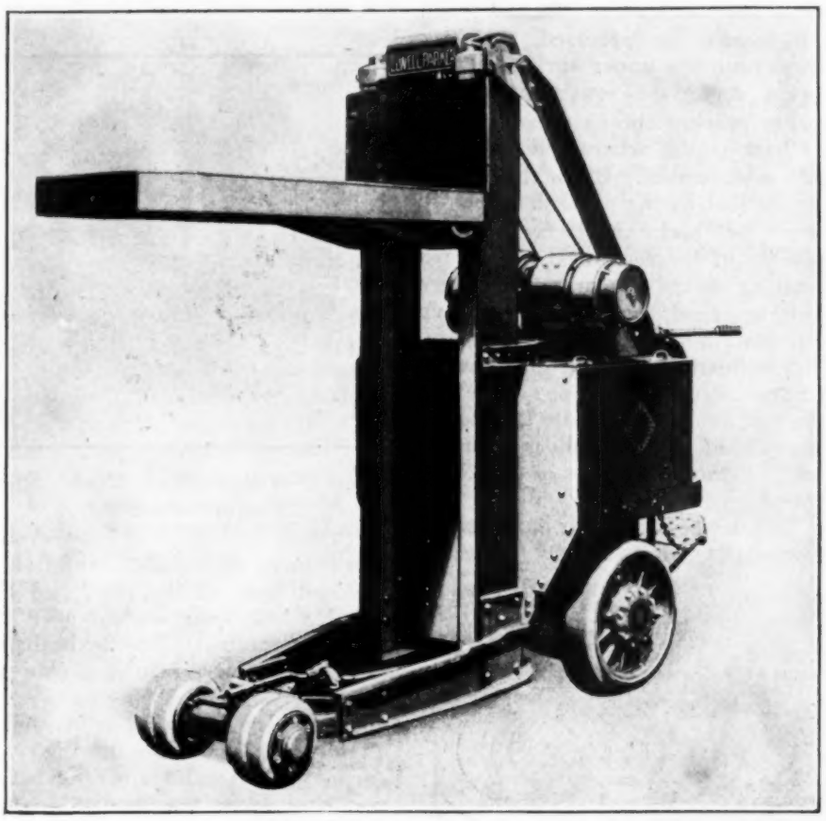
The motor-drive apparatus operates on the same principle as the one described and it is possible to throw the standard, squirrel-cage, induction motor directly on the line. Since the motor starts under no-load conditions, it immediately jumps to approximately 90 per cent of full-load speed, and the friction clutch gradually applies the load. The motor then reaches its full-load speed gradually.



Tolhurst Friction Clutch Pulleys

Elwell-Parker "Hi-Lo Tructor"

"Hi-Lo Tructor" is the designation applied to a heavy-duty portable electric elevator which the Elwell-Parker Electric Co., Cleveland, Ohio, is now marketing. This machine is



Elwell-Parker "Hi-Lo Tructor"

adapted for the handling of heavy castings, dies and parts, and their transportation over rough floors.

The tructor will take a load at any height up to 6 ft., transport it, deposit it on the floor, or at any height up to 6 ft. The load capacity is 6,000 lb. and the device is 112 in. long and 95 in. high. It can be driven through a 42-in. doorway.

Since this truck is designed to receive loads near the floor, there is little room for mechanism below the platform and it is accordingly built as a cantilever from the elevator upright. The heavy arms which support the platform have a vertical portion at their rear ends and on each of these are mounted two rollers which carry the thrust of the platform and its load, the lower pair being flanged and rolling on the face of the channel uprights of the elevator. The upper pair contact with the inside of the channel flanges.

The platform weight is partially counterbalanced by the moving portion of the hoisting mechanism which is mounted on the rear ends of the platform arms. The power for hoisting is derived from an Elwell-Parker motor, located on top of the battery compartment and connected to a double-grooved hoist drum. From this drum two cables run over sheaves at the top of the elevator frame to a secondary drum which is keyed to a shaft on the platform. This shaft carries pinions at its outer ends, which mesh with a vertical rack on the frame.

As the cables are wound on the hoisting drum the secondary drum is caused to revolve, raising the platform through the pinions and racks. A limit switch is provided to prevent overtravel at either end of the lift and also opens in case the platform strikes an obstruction while being lowered.

The underframe is constructed of heavy steel castings and the structural frame is riveted to it. The unit power plant is supported at three points and consists of an enclosed Elwell-Parker motor direct-connected to a bevel or worm gear differential. The service brake drum is located between motor and differential.

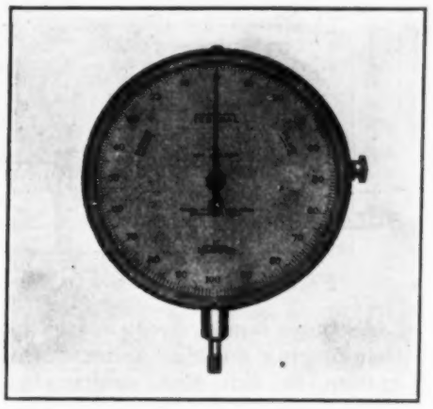
The front axle is a steel casting in which a heavy steel axle carries two wheels on knuckle pins for steering. Each wheel is fitted with two rubber-tired treads which have a differential action when steering, but act as one tread when carrying the load in a straight line.

The usual automatic interlocked control is provided. The truck with the battery weighs 5,200 lb., travels at from 300 to 400 ft. per min., and raises the rated load at from 5 to 6 ft. per minute.

Federal 0.0001-In. Dial Gage

The Federal Products Corp., 15 Elbow St., Providence, R. I., has recently brought out an addition to its line of dial gages, designed to be applied to the Federal cylinder gaging and other apparatus as shown on page 642, Vol. 58, of the *American Machinist.*

The dial is 3⅝ in. in diameter and is graduated to read in increments of 0.0001 inch. Notwithstanding the increased amplification of the reading, the graduation marks are



Federal 0.0001-In. Dial Gage

the same distance apart, measured circumferentially, as the 0.001-in. marks of the smaller dials, thus rendering the gage easy and convenient to read.

Two styles of graduation are regularly furnished, the style shown in the illustration reading either way from 0 to 100 (0.01 in.) plus or minus. The other style is direct-reading from 0 to 200. The latter dial is also furnished with a second hand, if desired, to show the number of revolutions made by the main pointer.

Rocker Type Drop Lock for Ajax Forging Machines

A stop motion device called a rocker type drop lock has recently been developed by the Ajax Mfg. Co., Cleveland, Ohio, and has been adopted as standard equipment on its late model bolt heading and upsetting forging machines, after a thorough trial in actual service. The mechanism is illustrated in Fig. 1.

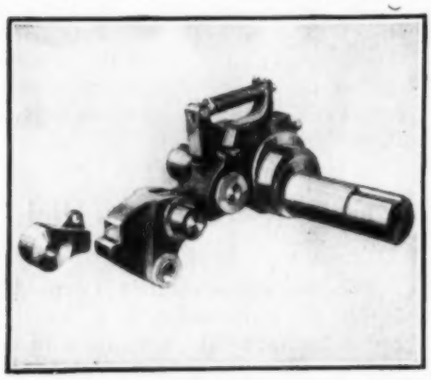


Fig. 1—Ajax Rocker Type Drop Lock

pin end of the pitman being carried by an oscillating rocker *B* fulcrumed at the bottom of the header slide. The rocker swings free under the drop lock *A*, as shown in Fig. 2, while the machine is idle and when the treadle is depressed, the lock drops onto the upper surface of the rocker and rides on it until the rocker reaches the extreme limit of its back travel, where the lock falls into engagement. Since this action occurs just as the crankshaft passes over its back dead center, the velocity of the reciprocating and oscillating parts is practically zero when engaged, the slides are thrown into motion under a natural acceleration without shock, and for as many strokes as desired. Upon removing the foot from the treadle the lock is disengaged and the slides come to rest at the extremity of the back travel.

The device is similar in principle to the slide block type of drop lock previously used on Ajax machines, but it is superior to the former design in the shortness of the lock, the increased engaging area, and the smoother action. Its relatively light weight also eliminates the necessity for the counterweight and timing lock used with the old design.

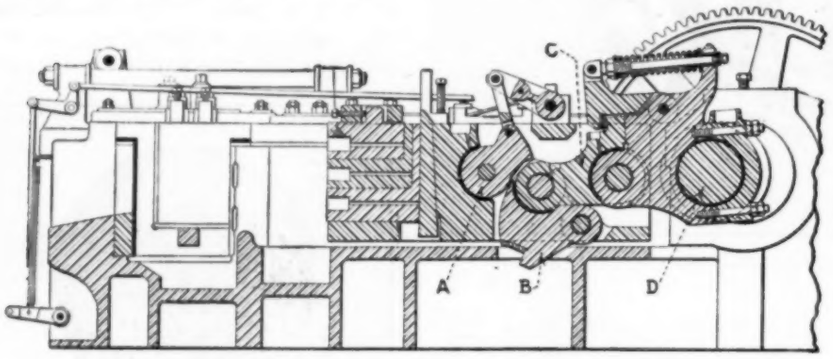


Fig. 2—Drawing showing position of drop lock on idle strokes

As those familiar with a stop motion forging machine know, the operation is somewhat similar to a punch press, in that the slides remain at rest until the hot stock is located in the impression in the stationary die and the machine is tripped. In operator-controlled machines, where the method of bringing the slides into action is by means of a hub clutch in a revolving gear or flywheel engaging direct with the end of a crankshaft which is at rest, the sudden acceleration of the crankshaft to full speed results in a severe shock, especially when the moving members are heavy.

With this improved drop lock device the crankshaft *D*, Fig. 2, with pitman *C* attached, is in idle rotation when the slides are at rest, the wrist-

Palmer-Bee High Speed Flexible Coupling

A flexible coupling for use in coupling high speed motors to speed reducers, and for similar applicatons, has recently been developed by the Palmer-Bee Co., Detroit, Mich., and is now being marketed. The coupling is shown in Fig. 1 and consists of a pair of disks having round pins projecting from their adjacent faces, the pins being arranged so that a continuous belt can be passed over and under alternate pins. This arrangement forms a series of loops through which the driving torque is transmitted from one disk to the other.

The use of a continuous belt in conjunction with the smooth round

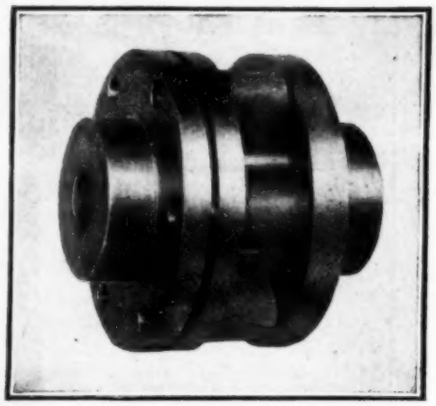


Fig. 1—Palmer-Bee High Speed Flexible Coupling

pins insures the equal distribution of the load over all the pins, and distributes the wear evenly over the length of the belt. The flexibility of the belt is also said to eliminate not only the larger vibrations due to misalignment and endwise movement of the shafts, but also any high frequency vibration or humming action resulting from the use of toothed gearing.

The disks are of high-grade cast iron and the pins are of steel, all parts being machined all over. A belt of the best quality rawhide is supplied for ordinary use or, if the coupling is to be used in an exposed position, a belt of especially treated fabric can be supplied.

One of the disks is extra heavy and has a slot cut in the periphery to such a depth that, when the pins are in position, each pin is exposed in the slot. Each pin is grooved, as can

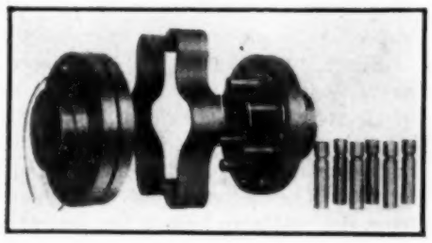


Fig. 2—Palmer-Bee Coupling Disassembled

be seen in Fig. –, at the point where it is exposed in the slot in the disk. When the pins are in position, a steel spring is snapped into place in the slot in the disk, locating in the grooves in the pins and acting as a retainer. This construction makes it possible to take out the pins quickly and remove the belt without separating the coupling or disturbing the alignment of the motor or reducer. The coupling is furnished in sizes from 4 in. to 20 in. in diameter.

Clare Universal Self-Locking Chuck

The chuck shown in the accompanying illustration and manufactured by Clare-Collets, Ltd., Manchester, England, has recently been placed on the American market by the A. C. Bellefleur & Son Co., 81 Hamilton St., New London, Conn. This chuck and the combination drill-reamer, also marketed by this company and described on page 971, Vol. 59, of the *American Machinist*, are both patented in the United States.

The chuck is made up of three parts, the body, the collet, and the retainer. The illustration shows an assembled tool with extra collets beside it. The main feature of the

Clare Universal Self-Locking Chuck

chuck is its self-locking quality, the torque applied to overcome the resistance of the drill causing the collet to grip the drill shank very tightly.

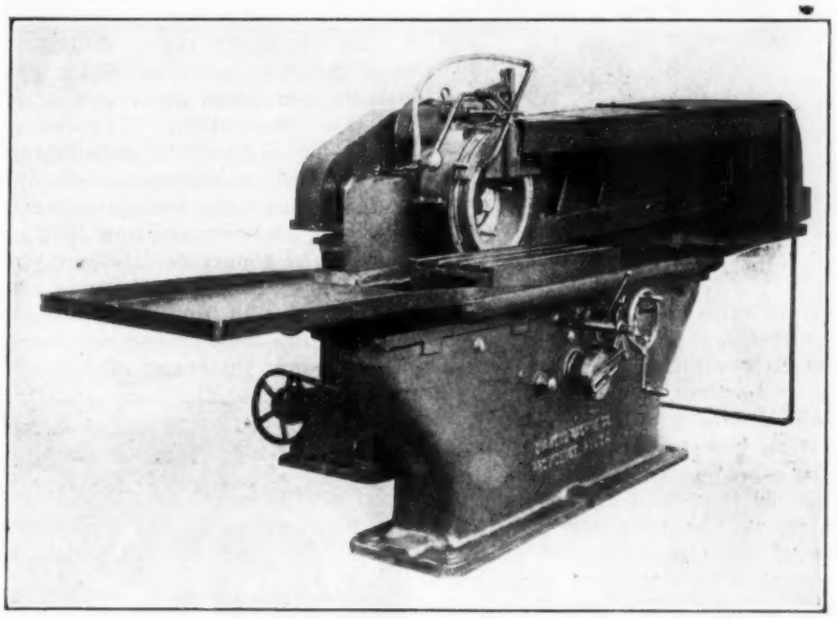
The gripping action is caused by a left-hand thread on the collet, any relative motion between the chuck and the drill during the drilling operation tending to screw the collet down into the retainer. This not only causes a tighter grip of the collet, but also tends to turn the retainer in such a direction that it will be screwed tighter upon the body of the chuck, thus adding to the tightness of the grip.

It is stated that, although the grip of the collet is exceptionally tight, it can be released in most cases by hand or a light tap on the retainer wrench furnished with the chuck. The tool will handle taper shanks and straight shanks, with or without tangs, with equal facility. The tang of the drill takes none of the driving strain and there is little possibility of breaking the tangs, since the grip of the collet on the body of the drill provides the driving force.

The chuck is furnished in five sizes with a variety of collets to handle from No. 1 to No. 5 Morse taper shanks and from ½- to 1½-in. straight shanks.

Diamond 18-In. Face Grinding Machine

The Diamond Machine Co., Providence, R. I., has recently added an 18-in. size to its line of face grinding machines. The machine is similar to the large size described on page 583, Vol. 39, of the *American Machinist*, and is designed to accommodate smaller work, releasing the larger machines for work in proportion to their capacities. The finishing of flat surfaces usually machined on the planer or milling machine is a type of work to which this machine is particularly adapted.



Diamond 18-in. Face Grinding Machine

The machine is rigidly constructed and is motor-driven, two motors being required. A 10-hp. motor is connected to the abrasive wheel shaft through a silent chain, and may be a 50-deg., d.c. motor running at 1,800 r.p.m., or a 60-cycle, 2- or 3-phase, a.c. motor of standard make. A ¾-hp. motor, running at 1,200 r.p.m. drives the table through 2-in. belts.

The grinding wheel is of the solid ring type and is mounted in a steel-bound chuck. The wheel is 18 in. in diameter, 5 in. deep, and has a 15-in. bore. The spindle is 3½ in. in diameter, carried in bronze bushed bearings 5½ in. long and provided with ball thrust bearings.

The table is 14 in. wide and is equipped with cross-feed from front and rear, operated by hand. The table drive gears are all of steel and the traversing rack is 1¾ in. wide. The machine is built with various capacities to handle work from 24 to 60 in. in length, and 10 in. in height. If necessary, the allowable height can be increased to 14 in. by removing the guard flap from the grinding wheel cover.

It is stated that this machine has finished a lot of eccentric straps, shown mounted on the table in the illustration, at the rate of 72 per hr. The total number was 1,300 and the total time consumed included that necessary for oiling and care of machine, as well as grinding. On some other work this machine is said to have increased the production four times over previous methods.

Hopper Type Magazine for Cleveland Automatic Screw Machine

For a number of years the Cleveland Automatic Machine Co., Cleveland, Ohio, has equipped its standard machines with magazine feeds where separate pieces were to be machined instead of the more common bar work. Aside from certain special magazines, some of which have been mounted on the cross-

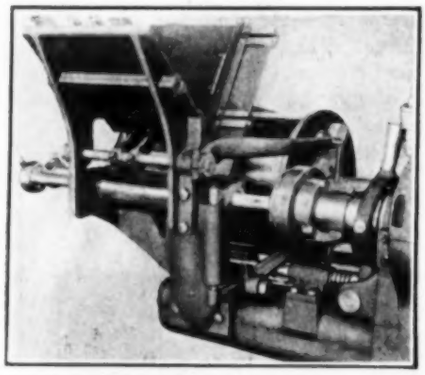


Fig. 1—Cleveland Hopper Type Magazine

slide or otherwise, the models A and C turret type automatics have been regularly supplied with rotary tilting magazines, and the model B plain automatic with a gravity feed vertical type magazine. This latter type of magazine has recently been changed to a hopper style in order to handle efficiently a greater number of parts and allow the operator more time to fill it, since the rapidity with which the machines handle the work empties the old style of magazine quickly.

The hopper type magazine is shown in Figs. 1 and 2, and it is now developed to such an extent that little care is needed in placing the parts in the hopper. All that is necessary is for the operator to see that the end to be machined is placed toward the chuck of the machine.

As shown in Fig. 1, the agitator is operated by means of a lever and roll, the roll being in contact with a cam mounted on the end of the magazine drum cam. This cam oscillates the shaft on which the lever is mounted and operates two arms which are clamped on the shaft and connected to the agitator racks inside the hopper. The oscillating movement of the racks prevents clogging of pieces in the lower opening of the hopper.

A guide tube bushing is located directly under the hopper opening below the agitator shaft and is machined to the form of the part being handled. After receiving the piece fed into it the tube bushing is turned by means of a rack operated by a lever below. The other end of this lever passes under the compression collar to the rear of the machine, where it comes in contact with a notched plate mounted on the side of the magazine cam drum. The action of this mechanism makes it possible for the guide bushing to hold back other pieces in the hopper while the piece which has just been fed into it is being pushed forward to the chuck by the push rod *B*, Fig. 2. The agitator racks previously mentioned, are shown at *A*, in this illustration. The entire mechanism is timed to work rapidly and smoothly so that as one piece is ejected from the chuck another is ready to feed forward and take its place. The hopper has a capacity of from 200 to 600 pieces, depending on the diameter of the stock. It will handle studs, pipe nipples, wristpins, dowels, and numerous other parts

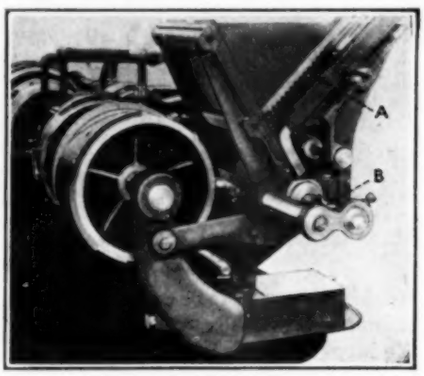


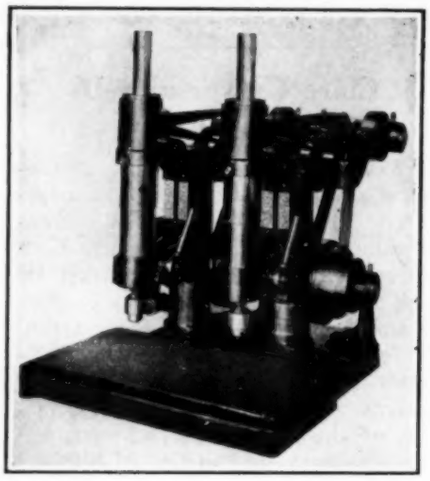
Fig. 2—Interior of Cleveland magazine showing agitator racks

from castings or cut bar stock requiring first or second operations.

A very efficient combination is made by the use of two machines, one with regular feed for first operation work on studs or nipples, and the other with magazine feed for threading the opposite end. This keeps up a constant production flow with a low operating expense, requiring about one-eighth of the operator's time. The magazine attachment can be quickly removed at any time and the machine used for bar stock.

Sigourney Two-Spindle High-Speed Drilling Machine

The Sigourney Tool Co., Hartford, Conn., has recently brought out a two-spindle bench drilling machine of the ball-bearing, high-speed type illustrated on page 742, Vol. 57 of *American Machinist*. In this machine the horizontal shafts are



Sigourney Two-Spindle High-Speed Drilling Machine

mounted in S.K.F double-row bearings and the spindles in Norma bearings.

The bearings of the spindle pulleys are entirely independent of the support of the spindles and the latter are not, therefore, affected by belt tension. The upper countershaft of each head is independently adjustable to maintain the tension of the respective belts. The spindle, pulley and sleeve are enclosed within telescopic guards to restrain flying oil. A removable stationary tube encloses the upper end of each spindle.

The machine occupies a bench space approximately 19 in. square, including all overhang. The available work surface of the table measures $7\frac{1}{2}$x$14\frac{1}{2}$ in., and is surrounded by an oil channel. The distance between centers of the spindles is $6\frac{1}{2}$ in., and either spindle will drill to the center of an $8\frac{1}{2}$-in. circle.

The spindles have No. 1 Morse taper holes to accommodate taper shank drills up to $\frac{1}{2}$ in. in diameter. For drills $\frac{7}{16}$ in. in diameter and under, standard drill chucks are supplied as regular equipment. The available rotative speeds range from 950 to 3,000 r.p.m. The heads may be adjusted independently through a range of 6 in., and the vertical move-

ment obtainable by the rack and pinion is 2⅞ inches. A conveniently located stop, provided with a screw for close adjustment, regulates the depth of hole to be drilled.

All pulleys are balanced, and the machine is shipped with belts in place, ready for use. Machines can be driven directly from a line shaft if desired, as the tight and loose pulleys on the lower horizontal shaft obviate the necessity for an overhead countershaft. The approximate weight of the machine is 100 pounds.

Improved Feed Mechanism for Hendey Shapers

An improved feed mechanism has recently been applied to the crank shaper manufactured by the Hendey Machine Co., Torrington, Conn., and described on page 156, Vol. 57 of the *American Machinist*. The device will be furnished upon all shapers of this type in the future, and is shown in Fig. 1 mounted on the machine.

In this mechanism the pawl is not connected directly to the crank pin from which it derives its movement, but is actuated by a swinging sector, the amplitude of movement of the sector remaining constant regardless of whether the pawl is giving the maximum or minimum feed. The number of teeth that the pawl is allowed to engage is determined by an annular cam, the position of which is under control of the operator by means of the knurled handle *A*, Fig. 2, and the amount of feed for which it is set is indicated in thousandths of an inch upon the graduated dial *B*, shown in the same illustration.

The projection *C* is a part of the swinging sector and imparts movement to the hardened steel roller *D*, which is mounted on the independent

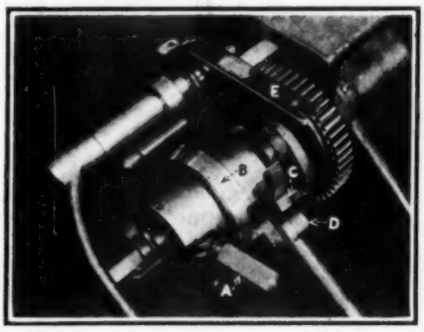


Fig. 2—Hendey feed mechanism with cover removed

pawl sector. When the pawl has completed the arc for which it is set, the annular cam of the graduated dial *B* lifts the roller over the projection *C*, allowing the latter to continue its full movement, while the pawl sector is returned to the starting point by the action of a torsion spring and is idle for the remainder of the stroke.

The action of the feed pawl is always in one direction. To reverse the direction of movement at the table, a small lever mounted on the feed mechanism cover is pushed from one extreme position of its movement to the opposite extreme position. This action moves the bar *E*, Fig. 2, operating the double-throw feed screw clutch. At the center, where the lever is held by a spring detent, the feeding mechanism is entirely disconnected from the feed screw and there is no possibility of accidental movement of the table.

The amount of feed is adjustable in increments of 0.005 in. from 0.005 in. to 0.175 in. by pulling back the knurled handle to disengage the clutch teeth of the graduated dial, turning the dial by means of the same handle until the desired graduation coincides with the zero line on the stationary dial, and allowing the clutch teeth of the dial to reengage. It is accomplished in a single movement of one hand by the operator, and the zero line is always at the top and in full view. The cover provides an oil pocket into which the pawl and swinging sector dip at each stroke and thus insure ample lubrication.

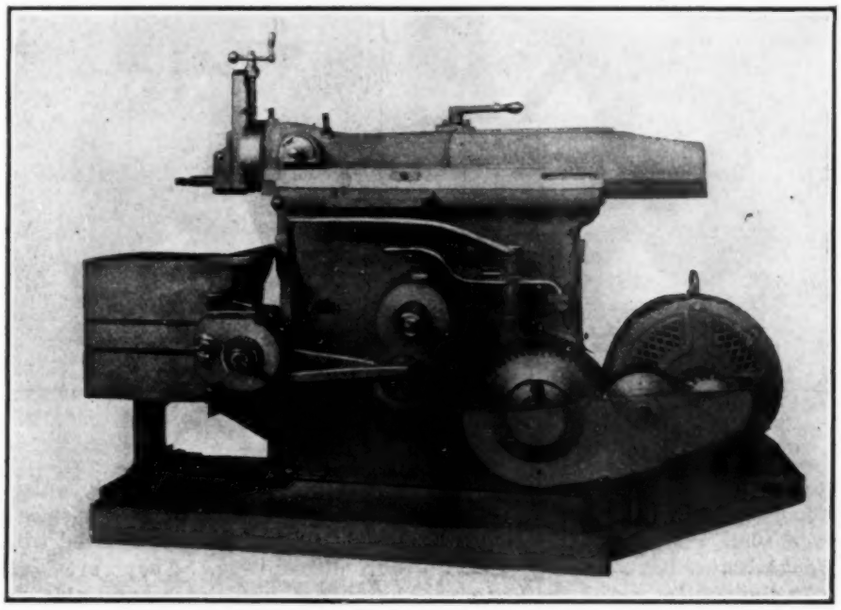
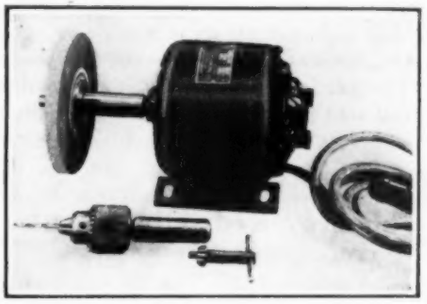


Fig. 1—Hendy Shaper with Improved Feed Mechanism

Bisgood Portable Drilling and Grinding Outfit

A. C. Bisgood, 286 Courtland Ave. Bridgeport, Conn., is now marketing the combination shown in the accompanying illustration, consisting of a fractional-hp. electric motor, a grinding wheel, a drill-chuck and an



Bisgood Portable Drilling and Grinding Outfit

adapter. The combination is useful for light grinding, burring, drilling small holes, and for light filing, such as would be done on a bench or speed lathe.

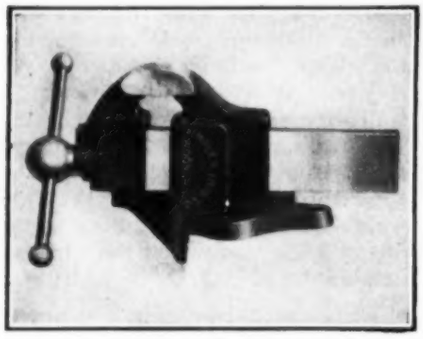
Requiring no connections, fastenings or arrangements other than being brought within reach of an electrical outlet fitted with a standard lamp socket, it can be transported readily to any part of the shop where its services may be required.

A standard motor can be furnished for the desired current, voltage or frequency.

"Simplex Gray" Bench Vise

An exceptionally rugged bench vise has recently been placed on the market by the Simplex Tool Co., Woonsocket, R. I., and is designated the "Simplex Gray." The accompanying illustration shows the general construction of the tool.

An important feature of the construction is the use of an all-steel slide. The use of steel for this part



"Simplex Gray" Bench Vise

gives exceptional strength as compared with a cast-iron slide. The body is cast of a special tough grade of crucible iron and the jaws are of steel, hardened and ground.

The vise screw has square threads and is also of steel. It is retained by a cap in front of the sliding jaw so that it has been unnecessary to core the inside of the vise for a collar. The nut is of ample length and easily replaceable. The vises are furnished in sizes from 3- to 7-inch.

Besly "Redisc" Cement

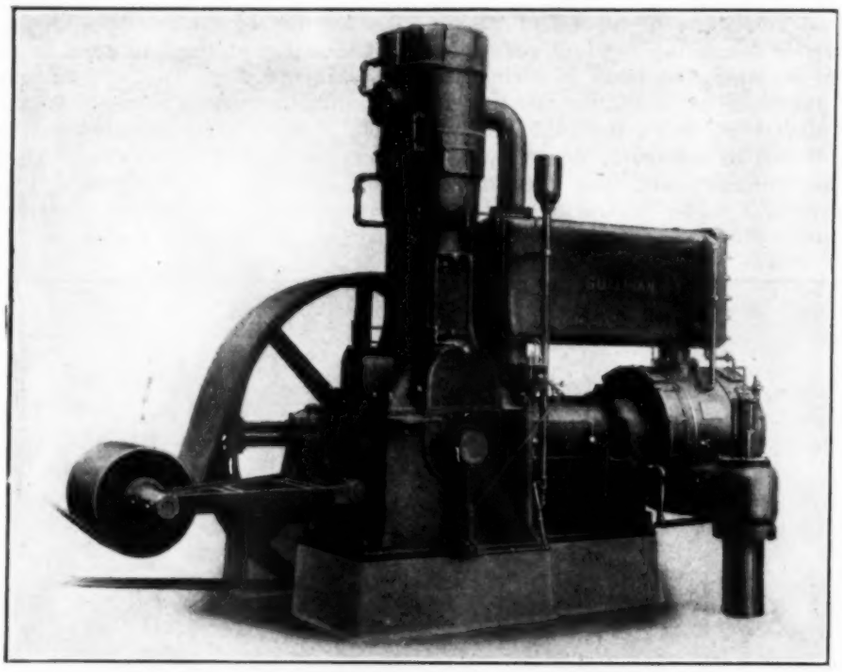
Abrasive disks can be attached to steel disk wheels and be ready for use in approximately 15 minutes, by the use of Besly "Redisc" cement, a waterproof powdered cement which has recently been placed on the market by Charles H. Besly & Co., 118 North Clinton St., Chicago, Ill. The steel wheel, upon which the abrasive disk is to be cemented, is placed over a gas plate or other heating apparatus of sufficient capacity to heat the steel disk evenly all over. While the disk is still cold, enough of the cement is sprinkled over it to cover the surface. When the cement starts to melt, it is spread evenly and the abrasive disk is placed in position, after which it is put under a press and left for approximately 15 minutes, when it should be cool. As soon as it is cold, it is ready to use.

Worn out disks are removed by the simple process of heating the disk wheel until the cement melts. It is possible to change from one grade or grain of disk to another quickly and without injuring the disk that is removed. The latter can be returned to stock and used again when required.

"Redisc" cement is waterproof and is therefore adaptable for use in wet grinding, which is often desirable but not practical when a cement that is not waterproof is used. The cement works equally well on the heavy cement-bond type of abrasive disk or on the thin glue-bond type. The glue-bond type cannot, of course, be used for wet grinding. "Redisc" cement is furnished in powdered form in one pound cartons.

Sullivan Angle-Compound Air Compressor

A belt-driven angle-compound air compressor, of particular interest to plants requiring an independent compressed air supply, is now being marketed by the Sullivan Machinery Co., 122 South Michigan Ave, Chicago, Ill. This machine follows in general design the compressor previously illustrated and described on page 1098, Vol. 45, of the *American Machinist*.



Sullivan Angle-Compound Air Compressor

In the present model the low pressure cylinder is located in the horizontal position, the high pressure cylinder being placed vertically above the crankshaft. The connecting rods to both cylinders are attached to the same crank, the shaft passing out through the frame and carrying the large belt pulley. Beyond the pulley a substantial outboard bearing is provided on machines with more than a 12-in. stroke.

The intercooler is mounted directly above the low pressure cylinder and is of the three-pass, countercurrent type. The shell is of cast iron and flanged connections are provided between the intercooler and the cylinders. A drain trap for oil and water accumulation is provided at the inner end and a pop safety valve is mounted at the top.

The main bearings are made in four pieces which can be removed without taking out the shaft. The bearings are lined with babbitt and have a suitable wedge adjustment. The connecting rods are forged and the crosshead guides are bored in the frame.

The air valves are of the Sullivan double-wafer type for both intake and discharge. These valves are actuated by the pressure of the air and have no mechanical connection with the compressor mechanism. Each valve and valve seat is a separate unit and can be removed without dismantling. They are fully automatic and interchangeable for all sizes of compressors.

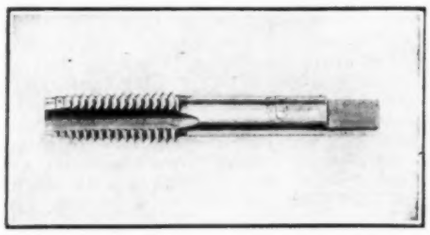
All moving parts are provided

with positive, automatic lubrication and are entirely enclosed within the frame of the machine. When space is limited an idler pulley and bracket will be furnished to reduce the distance between driving centers, as shown in the accompanying illustration.

Flanders Ground Taps

The Jones & Lamson Machine Co., Springfield, Vt., is now marketing the Flanders ground taps in a variety of sizes. The shanks and thread form of these taps are ground to accurate shape and dimensions after the tools have been properly hardened.

The pitch diameter of the taps is held to a tolerance of 0.0008 in. by the grinding process, and the lead error is held within plus or minus



Flanders Ground Tap

0.0005 in. These limits are based on the close fit determined by the National Screw Thread Commission and with proper lubrication, alignment and cutting pressure, and in ordinary materials, are intended to produce holes within the limits of that fit.

Standard taps can be furnished in sizes from ¼- to 1-in. in both the coarse and fine thread series. The over-all lengths vary from 2½ to 5¼ in. Special taps can be furnished if required.

The advantages claimed for these taps are accuracy and increased production. Distortion produced by the hardening heat is corrected by the grinding process. Under proper operating conditions the ground taps will cut accurate threads and make unnecessary the fitting of screws at assembly.

All these taps are made from high-speed steel. It is said that they will give better results than unground taps of the same material; first, because they can be carried to full hardening heat, since fused points and edges are corrected in grinding; second, because the ground cutting edges give better cutting action of the teeth.

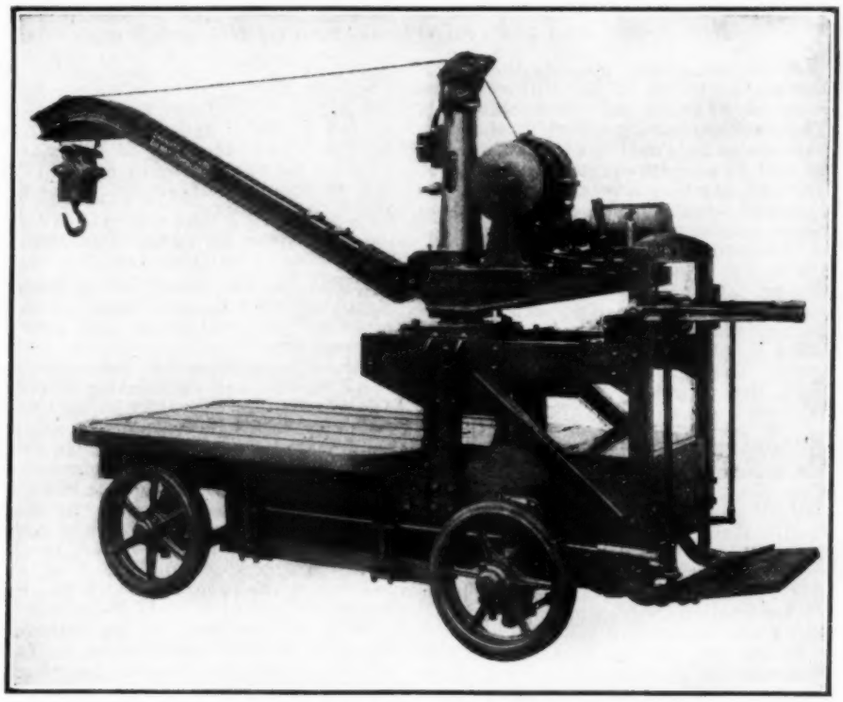
Crescent Industrial Crane Truck

The industrial crane truck shown in the accompanying illustration is a recent product of the Crescent Truck Co., Lebanon, Pa. The crane proper is mounted on a structural framework adjacent to the dash.

An independent motor drives the hoisting drum through worm gearing, the weight of the mechanism counterbalancing the load. The lifting capacity is 1,500 lb., and the crane is of the compensating type with four fixed boom positions. The hoisting motor is operated through a standard drum-type controller. The crane apparatus swivels through an angle of 180 deg. so that the load can be picked up over either end or at the side.

The truck proper is a standard Crescent GC unit with a 66x44-in. platform. The height of the platform above the floor is 24½ in. and the over-all length is 9 ft. 3 in. The turning radius is such that the truck can be driven into a box car of standard dimensions.

All controls for the travel of the truck are located at the operator's position and the usual safety interlocking devices are provided. Circuit breakers are also fitted to the crane mechanism to insure proper operation, and obviate overloading difficulties.



Crescent Industrial Crane Truck

American Export Figures for Last Year

Many significant changes in the direction of American exports and imports took place during the first nine months of 1923. While some of the country's best customers—notably in Europe—purchased less from the United States during the first three quarters of the year than during the corresponding period of 1922, the total value of American exports was $203,000,000 greater, owing to increased shipments to Latin America, Canada, and Australasia. In fact, out of a total of 113 countries in the world, 66 countries bought increased amounts of American merchandise, while the remaining 47 were on the wrong side of our ledger, according to a statistical study made by the Foreign Commerce Department of the Chamber of Commerce of the United States in preparation of its quarterly analysis of Our World Trade.

In Europe, the most important outlet for American wares, two-thirds of the countries reduced their American purchases. The loss in exports to the United Kingdom amounted to $33,000,000, or 6 per cent, while our exports to Germany sustained a 5 per cent loss, and to the Netherlands a decline of 11 per cent.

The quarterly sales survey thus far received from the foreign representative of the Department of Commerce indicate generally that 1924 will be a good year for American exports of automotive products. The outlook in United Kingdom, South Africa and Australia are particularly promising. Distinct improvements have also been noted in trade conditions of India, Czechoslovakia, and Austria.

News of the Week

Many Problems Discussed at Regional Meeting of Chamber of Commerce

Railroads and tax reduction, two of the subjects

At its last annual meeting the Chamber of Commerce of the United States adopted a policy of decentralization. The first regional meeting under this policy was held in Philadelphia on Jan. 17 and 18 and apparently vindicated it. The first day was devoted to transportation and taxation, the second to merchant marine and immigration.

The transportation session was featured by the address of President Samuel Rea of the Pennsylvania Railroad. Mr. Rea said that although our railroads are the best in the world there is plenty of room for improvement. There can be little improvement until the railroads earn a steady six per cent on a fair valuation. Four points of attack present themselves: rate readjustment, labor cost reduction, tax reduction and increase in efficiency. The last point should be considered under two heads, better use of existing facilities and provision of greater facilities. The latter depends entirely on credit stabilization. Mr. Rea said that the Pennsylvania's plan of employee representation was working satisfactorily and constantly improving.

In the tax session Hon. Garrard B. Winston, under-secretary of the U. S. Treasury, explained the administration's taxation reduction program. He cited figures to prove that a bonus and tax reduction are incompatible. The certificate plan now being pushed would cost about one billion dollars for the first four-year period and over five billions during the 20-year life of the certificates.

Tax Problem Thoroughly Discussed

Mr. Winston said that taxes inherently excessive are not paid. Some means of avoiding them has always been found. History indicates that a ten per cent tax, the old Hebrew tithe, yields the maximum return with the least drying up of the source.

The tax committee of the chamber brought in a report containing the following recommendations:

"There should be revision of the normal and surtax rates on individual incomes to an extent equal in its results on revenues to a large part of the surplus anticipated at the end of the fiscal year.

"In the rates of federal income tax there should be differentiation between earned income and other income.

"War excise taxes confined to particular businesses should be repealed.

"There should be an amendment to the Constitution permitting non-discriminatory taxation reciprocally between the federal government and the states of income derived from future issues of securities made by or under the authority of federal and state governments.

"There should be set up in the Treasury Department, independently of the Bureau of Internal Revenue, a board of tax appeals, under such conditions of salary and otherwise as will make it possible for the Secretary of the Treasury to obtain the services of men of the highest ability.

Relieving Internal Revenue Commissioner

"That the Commissioner of Internal Revenue be freed of all duties with respect to the prohibition act and the narcotic act.

"Such conditions for recognition of merit, salary, and permanency in tenure for competent men should be established as will make possible an efficient organization and reduce turnover of responsible employees to a minimum.

"That Congress direct the Commissioner of Internal Revenue to decentralize administration as rapidly and as far as possible, and to report to Congress not later than Jan. 1 of each year upon the progress which has been made.

"The various parts of the Bureau of Internal Revenue now located in Washington should be brought together in one suitable building.

"Arbitrary assessments designed to extend the limitation period fixed in law should be prohibited.

"Taxpayers should be informed of all rulings which may affect their rights, adversely or favorably.

"That Congress expressly authorize the filing of a tentative return on the present due date with a right to file a final return not more than three months later.

"There should be created a joint committee, with members from both Houses of Congress and representatives of the public, to make a thorough study of federal taxes, simplification of the law for the income tax, and improvement in administration and to report its recommendations to Congress."

Mr. Willis H. Booth of the Guaranty Trust Co., president of the International Chamber of Commerce, told the meeting that a prominent member of the British Labor Party had said to him in conversation that conditions in Europe were worse than at any time since the peace treaty. Country by country, Mr. Booth took up the continent of Europe and showed that with few exceptions the reverse is true. He laid England's trouble to the unemployment doles which have tended to reduce the emigration that has taken care of her surplus population in other crises.

At the informal dinner President Julius H. Barnes paid tribute to Benjamin Franklin whose birthday was being honored and commented on the tremendous strides made in substituting machinery for human labor. He closed his remarks as follows:

"In their last analyses, it may be noted that all these national questions may be tested by one of three typical American ideals.

"An industrial ideal, that believes in stimulated production; the transformation of nature's resources into human service, but the accomplishment of this by lifting drudgery from the backs of labor, and utilizing the power of mind and intellect in the processes of machine production instead.

"A social philosophy, that would close no door of advancement because of accident of birth, or of station, but that would make character or ability the test of leadership.

"A political philosophy, that believes that Government is primarily for the maintenance of fair play and equal opportunity,—the truest liberalism, because it asks no favor or advantages but the equal chance for men to attain their place by their own character and ability and their willingness to work."

The government's immigration program was presented by Hon. E. J. Henning, assistant secretary of labor, as the first feature of the immigration session. He contrasted the economic and sociological aspects of the problem with emphasis on the latter and made a strong plea for registration of aliens. The other speakers devoted most of their attention to the effect on industry and agriculture of the northern migration of the Southern negro.

Italian Engineers for American Factories

Fifty young Italian engineers, recent graduates of technical schools, will sail shortly for New York to become laborers in American industrial centers, it was announced recently by President James Hartness of the American Engineering Council. Their arrival will be in consequence of a plan initiated by the Italian Ambassador to Washington, Prince Gelaise Caetani. It is planned to bring at least 100 men from Italy each year. Twenty-five of the first group will work in the Ford plant in Detroit. Seven will go to the Westinghouse Electric & Manufacturing Co. and three to the General Electric Co.

Expect Big Output of Steel

Steel mill operations are heavier this month than in December, marking the first upturn since last April, when the record high was reached, according to mill officials in Pittsburgh. Steel ingot production decreased by 5 per cent from November to December, the average rate in the latter month being 35,400,000 tons per annum, which was 18 per cent under the April rate.

Ambrose Swasey Wins Fritz Medal

The John Fritz Gold Medal, the highest honor bestowed by the engineering profession in this country, has been awarded for 1924 to Ambrose Swasey, engineer, manufacturer and philanthropist of Cleveland, Ohio.

The award was made, according to the announcement, "for the building of great telescopes, the founding of the Engineering Foundation, and the invention and manufacture of fine machine tools, precision instruments and military and naval range finders."

The most notable of Mr. Swasey's many public benefactions was the establishment, through a gift of $500,000, of the Engineering Foundation as the joint research instrumentality of the four great national societies of civil, mining and metallurgical, mechanical, and electrical engineers.

The medal was established in 1902 in honor of John Fritz of Pittsburgh, pioneer in the American iron and steel industry, and is awarded annually for notable scientific or industrial achievement. Previous recipients have been Alexander Graham Bell, Gen. George W. Goethals, Guglielmo Marconi, Sir Robert Hadfield of London, and Eugene Schneider of Paris, head of the Creusot works.

Mr. Swasey was born in Exeter, N. H., Dec. 19, 1846, of New England lineage. He learned the machinist's trade in Hartford, Conn., afterward removing to Chicago. Since the early eighties he has resided in Cleveland, where with Worcester R. Warner he established the Warner & Swasey Co., of which he is now vice-chairman.

Mr. Swasey's Record

Mr. Swasey is a past president and honorary member of the American Society of Mechanical Engineers, having been one of its organizing members. He is an honorary member of the American Society of Civil Engineers and of several other engineering societies of America and Europe. He is an Officer of the Legion of Honor of France and has received other honors at home and abroad.

Among the famous telescopes built under the direction of Mr. Swasey are the 36-in. Lick refractor at Mt. Hamilton, Calif., the 26-in. telescope of the Naval Observatory at Washington, the 40-in. telescope of the Yerkes Observatory at Williams Bay, Wis., and the 72-in. reflecting telescope of the Dominion Astronomical Observatory at Victoria, B. C.

Taylor Society Has Good Program

An interesting program has been arranged for the meeting of the Taylor Society that is being held at the Engineering Societies Building Jan. 24, 25 and 26. Following the business session that is held on the first morning of the meeting, the election of officers is held. On Thursday afternoon Joseph W. Roe, past president of the Society of Industrial Engineers, will preside and a paper entitled, "A Critical Analysis of Scientific Management" will be read by Henry H. Farquhar. A discussion led by Robert T. Kent, Philip F. Moen and Frank B. Gilbreth is scheduled to follow. Thursday evening Richard A. Feiss, president of the Taylor Society, will preside. H. P. Kendall of Boston will deliver an address on, "Types of Management: Unsystematized, Systemized and Scientific" and the discussion following will be led by Sanford E. Thompson, Nathaniel G. Burleigh and Percey S. Brown.

Friday Sessions

With Mr. Kent presiding, those attending the Friday morning session will hear a paper by John H. Williams on "Scientific Manager and General Administrative Control." H. S. Person, Newton C. Brainard and Keppele Hall will lead the discussion on this paper. After the buffet luncheon Stuart Cowan will read a paper entitled, "Scientific Management in Selling and Advertising" and the discussion will be led by G. V. S. Carroll, Philip J. Reilley, Joseph Hayes and Charles F. Pietsch. Friday evening Mary Gilson will read a paper entitled "Personnel Work in Scientific Management." Discussions will be led by Joseph H. Willits, Bernice M. Cannon, Philip W. Carter, Robert B. Wolf, George Soule and Mary Van Kleeck.

Two papers will be read Saturday morning, the first being "Scientific Management in Federal, State and Municipal Business," by Morris L. Cooke, and the second being, "Scientific Management in Other Countries than the United States" by Frank B. and Lillian M. Gilbreth. The discussion on these subjects will be led by Henry M. Waite and William H. Allen.

Closed Body Builders Consolidate

Cleveland is shortly to have one of the largest closed-body plants in the country. This comes as the result of the purchase by the Baker R. & L. Co., of the Rubay Co. The combined plants will employ 1,200 to 1,500 men. The inventories were not acquired with the realty and good will.

E. L. Bartlett, vice-president and general manager of the Baker company, says $100,000 will be expended in constructing dry kilns for lumber.

It is said present Baker contracts call for $3,000,000 worth of bodies. The addition of the Rubay plant gives the company a closed-body production capacity of 28,000 a year.

Collier Buys Airways Corporation

The sale of a controlling interest in the Aeromarine Airways Corp. to Barron G. Collier, New York, and his associates was announced today by the Aeronautical Chamber of Commerce.

The chamber also discussed that the original company had been reorganized to form the Aeromarine Airways Corp. of New Jersey, with headquarters in New York, and that two of its flying cruisers had been shipped from the Great Lakes to Florida to reinforce the Miami-Key West Bimini-Nassau-Cuba service fleet.

Charles F. Redden, president of the old corporation, will retain that office in the new organization.

Museum of Safety Is Re-Opened

The American Museum of Safety, which was closed during the war, was re-opened Wednesday Jan. 16 at 120 East Twenty-eighth St., New York City. The museum is maintained by a corporation, of which Arthur Williams is president and Mrs. Mary W. Harriman, George F. Kunz, Elbert H. Gary, Edson S. Lott, T. Commerford Martin, William H. Nichols and Arthur H. Young are trustees. Its purpose is the prevention of injuries and loss of life and elimination of hazards to industrial workers and the public generally.

Industrial Safety

Specimens of safety devices, materials and methods which are proving most effective for the prevention of accidents in factories, mines, railroads, streets and homes are shown at the museum. The exhibits range from asbestos suits for the protection of workmen engaged near fire or intense heat to devices for preventing accidents on punch presses. Seven hundred photographs show safety and welfare methods employed by the United States Steel Corp.

The opening was preceded by a luncheon of the Board of Trustees at the Uptown Club, at which A. A. Hopkins, director of the museum, was principal guest. The speakers included Mr. Williams.

Mr. Williams announced that James Speyer, treasurer of the Museum, authorized the use of the $50,000 he donated as the nucleus of a building fund. He also said the *Scientific American* will offer a gold medal for the best safety device exhibited during the coming year.

Committee Will Support Mellon Plan

Announcement of the formation of a Citizens' National Committee in support of the Mellon tax reduction program, under the Chairmanship of Major General John F. O'Ryan, was made recently.

All sections of the country and all shades of political opinion are represented in the membership of the Committee, including many Democrats prominent in the Wilson administration as well as Republicans.

The purpose of the new organization is to promote non-partisan support of the Mellon program and to bring about a better public understanding of basic taxation principles.

General Electric Shows Large Gains

The orders received by the General Electric Co. for the year ending Dec. 31, 1923, amounted to $304,199,746, compared to a total of $242,739,527 for the year 1922, or a gain of 25 per cent, according to a recent announcement by Gerard Swope, president of that concern. For the fourth quarter of 1923, orders totalled $74,452,442, as compared with a total of $66,568,333 for the corresponding quarter in the year 1922, or a gain of 12 per cent.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Cincinnati

The machine tool houses in Cincinnati report that production is increasing and that orders have been coming in from a number of fields. The curtailed operation of local concerns caused by the holidays and by the inventory season is now at an end and buying is proceeding on a larger scale. Manufacturers state that the orders placed by the automotive trade have held up well. The Ford Motor Co. has been in the Cincinnati market lately placing considerable orders for tools, while other automobile companies have been either ordering or making inquiries which are expected to develop into business in the immediate future. The railroads are again in the market. The Southern R.R., the Louisville and Nashville R.R., the Union Pacific R.R., and the New York Central R.R. have been buying somewhat extensively in the local market in the past ten days. Industrial purchasing has also gone along at a steady pace with the General Electric Co. and the Westinghouse Electric & Manufacturing Co. placing a good amount of business.

The production of lathes has increased since the first of the year. Inquiries have been brisk while there has been an encouraging increase in the actual placing of orders. Milling machines likewise are showing a slight gain in production at local plants. Here again sales are better than they were.

Drilling machinery is also in greater demand than it was and the outlook is favorable for improved conditions during February and March. The production of planers proceeds in a satisfactory manner. Inquiries have been good and orders have kept the plants running on a normal schedule. Electrical tools show no falling off in demand.

Woodworking machinery plants are still operating on a heavy schedule which calls for production on a plant capacity basis. Orders are being received in satisfactory quantities. Automobile accessory plants state that their orders call for large production in the next month.

Cleveland

Preparations are going ahead in machine tool plants in the Cleveland district to meet the anticipated increased demand for equipment by general manufacturing. Leading machine tool factors here, especially those engaged in the production of the lighter weight equipment, are basing their expectations on figures rather than facts.

In 1924 the machinery and machine tool builder may be expected to depend largely upon the automotive industry for the best outlet for equipment, unless the railroads and other large producers continue expansions.

Figures scanned by machine tool interests now being made by the automobile and truck producers, indicate that the favorable outlet in this connection may be duplicated and surpassed in 1924.

Two developments confirm the optimism indicated in equipment circles. The White Motor Co. is working at close to capacity now and operations at the Peerless plant have been resumed after a brief shutdown in order to prepare for the production of the new six cylinder car. Initial operations will be on the eight cylinder car.

Detroit

Automobile shop executives in Detroit report a larger winter business than ever before. There are reports of stored cars but this is not unusual as it is necessary to have cars available for spring delivery. Companies that are not storing cars are building finished units so that they can be assembled very rapidly when spring demand occurs.

More companies are getting into position to finance dealers so that they may have cars in stock this spring.

Many shops are installing new machine equipment both for increasing quantity and for improving quality. Gear tooth grinding is receiving much attention and new developments and refinements are under way in many plants.

While much of the talk of increasing production next year is unwarranted and unfounded, some of the big plants are actually getting into shape to increase the daily production materially.

Further developments in the four-wheel brake situation are to be expected.

Philadelphia

The machinery and machine tool industries in Philadelphia were little changed from what they were two weeks ago. A spirit of optimism was apparent among most of the dealers, while others saw little hope of immediate resumption of orders that would insure large scale production. Many of the machine shops are operating from 30 to 40 per cent capacity.

There has been an improvement in steel orders that has reflected a healthy state of industrial conditions generally. New orders in several of the mills during the first half of this month are reported from 25 to 50 per cent greater than in the corresponding period of December and considerably in advance of that period in 1923.

Railroad offices in Philadelphia, it is reported, are preparing specifications for bridges requiring considerable fabricated steel.

State and local labor agencies report a fair demand for skilled workers.

Manufacturers of heavy springs for trucks, etc., report a brisk business. Owners of large fleets of trucks have come into the market for their annual overhauling and replacement orders have been heavy. Prices are holding firm.

New York

Purchasing of machinery and machine tools in the New York district was steady during the past week. Railroad lists have not been received by dealers and nothing is expected from this source during the remainder of the month, except for necessities.

Buying from automotive industries has been better during January than during December and this promises to be a source of distribution for some weeks to come.

General industrials are buying lightly and deferred purchasing seems to be the attitude taken by many manufacturers.

Used tools found a ready market last week according to Centre St. dealers and they express the belief that this year will be a good one in the used tool market.

Machinery and machine tool exporting has been good during the first weeks of January.

Southern District

Machine tool sales during the first half of January in the Southern territory proved equally as good as they were during the first half of the same month last year. Heavier machine tools are being sold, principally to railroad companies and to the larger industrial plants. Industrial development in the South in 1923 established the largest record in nearly ten years, including new plants built by newly formed companies, and additional construction projects carried out by existing companies. Principal development was in the railroad industry, textiles, lumber and wood-working plants, and the various metal trades industries. Much of this development is just being completed. Furthermore, indications portend an even more active year for industrial development. The industries of the South are in the best shape financially in the past decade.

More than 400 building projects were reported for 1923 in the metal trades, of which more than 250 were in the foundry and machine shop field.

Inquiries the past two weeks have been somewhat more active than they were the previous month, with good inquiries still coming in for heavier tools, many of which are resulting in large orders. The textile industry is showing signs of inactivity again. Railroads continue the most active, another big construction project having been announced during the past ten days by the Southern System that is planning a big investment to improve its shop facilities at Birmingham, Ala.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance*, New York

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BUSINESS and world politics are now so intertwined that it is impossible to consider them separately. Last week Poincare, Ramsay McDonald, and our own General Dawes held the center of the stage and even the American Congress at Washington fell into the background. The words of truth and soberness spoken by General Dawes as he asked the world to "help Germany get well" seem to have fallen upon fruitful ground. Poincare has proposed an increase of 20 per cent in French taxes with economies and budgetary reforms that will be helpful if they are adopted.

The result has been an advance in the value of the franc that is as yet purely sentimental. It remains to be seen whether it will be maintained when the French people realize that they cannot hope to collect any very substantial portion of the 132 billions of gold francs that they claim from Germany.

America and England have never been disposed to question the mathematical justice of this claim, but their attitude has been that it is physically impossible for Germany to pay any such sum and until France is brought to see that she "cannot get blood out of a turnip" it is doubtful whether any financial necromancy can be worked by mere words even though they be uttered by General Dawes.

In England there has also been a sentimental reaction from the hysteria by which some were afflicted when it became apparent that the Government would fall into the hands of the Labor Party.

"Hope springs eternal" and it is now hoped that responsibility will sober the labor leader and his colleagues. "Wait and see" is the present attitude and as the financial markets wait they are becoming a little steadier, while sterling exchange has risen from its low of 4.22¼ on Monday to a high of 4.26⅞ on Wednesday.

But these reactions do not alter the fundamental fact that Europe is presently unable to stabilize her currency or re-establish the gold standard and that until she can make some progress in this direction the world's gold will continue to come here.

The figures of our foreign trade for December furnish another reason for expecting a continued influx of gold. Merchandise exports were valued at $425,000,000 and imports at $285,000,000. The result was a "favorable trade balance" of $140,000,000 for December, which was partially offset by the gold imported during the month, which amounted to $32,000,000.

For the year 1923 our net gold imports were $297,000,000 and the merchandise balance of trade in our favor was $376,000,000. Making allowance for tourists' expenditures and other invisible items it would appear from these figures that our international trade is now being conducted on a cash rather than a credit basis and that the cash used is gold.

This being so it is not surprising that the weekly statement of the Federal Reserve Banks shows a further gain of $26,000,000 in the gold held, a reserve ratio of 80.1 per cent and a decrease of $83,000,000 in earning assets, which now amount to only $943,000,000.

The situation thus disclosed is profoundly important to business men everywhere. That the Federal Reserve Board appreciates its significance is indicated by its action in so "rearranging" the weekly statement as to make it appear that $2,177,697,000 of the gold on hand is "held exclusively" against an equal amount of Federal Reserve Notes in circulation. As the balance of gold on hand is less than 50 per cent of the deposit liabilities the change appears to be a somewhat clumsy effort to camouflage the superabundant supply of gold.

The legality of the segregation attempted is, however, very doubtful, and as it is in any case more likely to advertise than to conceal the plethora of gold the result may be the very reverse of the one sought.

As this possibility becomes understood money is growing easier all over the country. Good commercial paper is now salable at 4½ per cent. In New York immense sums are to be had on call at 4 per cent and if the rediscount rate of the Federal Reserve Banks was fixed by the law of supply and demand it would speedily decline.

It remains to be seen whether public opinion will tolerate the maintenance of a 4½ per cent rate under such conditions.

In some sections of the country there is an insistent appeal for a reduction, and many think that it is inevitable. Reflecting this belief the stock market has been generally firm. There was some confusion and hesitancy on Tuesday, when francs were at their lowest, but this mood soon passed and the upward tendency is again noticeable as the implications of the financial position become better understood.

These implications include the probability of a rise in the price of everything except bonds, unless some way of checking the gold influx is found. Bonds are excepted, because they are nothing but contracts for the future delivery of gold and it is not to be expected that they will advance when gold is declining. It is not that the intrinsic value of shares or merchandise will be greater, but that the exchangeable value of gold will be less because we have so much of it.

Logically this effect should be first felt on the Stock Exchange, and it is already noticeable there.

In most other markets business has been quiet, but corn has been surprisingly strong at the highest prices of the season. But the whole business complex waits upon a solution of the American gold problem to the importance of which the country is becoming very much alive. Until it is disposed of caution tempered by optimism is likely to prevail.

What's Doing in Industry

Expansions were noted last week in some of the larger manufacturing concerns. Western Electric Co. and Westinghouse Electric & Manufacturing Co. both signified their intentions of additional building and equipping.

Automobile production is better for this season of the year than in any previous year and indications point to record output in 1924.

Railroad reports show better earnings for the past year and it is anticipated by rail officials that this business will be equaled in 1924.

Machinery and machine tool business is characterized as steady in most parts of the country with the record receipts of inquiries still current.

Electric railway companies purchased 4,029 cars during the past year and rebuilt 1,256 cars. Exclusive of amounts for labor, the railways spent $282,000,000 during 1923 in the purchase of new plants and for equipment and maintenance materials, and they plan to spend $262,000,000 during this year.

Both bituminous and anthracite stocks are in excess of any previous year and manufacturers are taking advantage of this situation to purchase for future needs.

Personals

ROBERT S. ALTER, vice-president of the American Tool Works Co., Cincinnati, has been elected a member of the board of directors of the Cincinnati Foreign Trades Association.

PHILIP O. GEIER, treasurer of the Cincinnati Milling Machine Co., has been elected a director of the Cincinnati Chamber of Commerce.

R. E. LUDWICK, formerly sales manager for the Cleveland Crane & Engineering Co., Wickliffe, Ohio, has joined the sales staff of the Whiting Corp., Harvey, Ill. His headquarters will be at 945 Monadnock Block, Chicago, Ill.

CHARLES SPAULDING is now with the Giddings & Lewis Manufacturing Co., Fon du Lac, Wis. He was formerly connected with Gisholt Machine Co., Madison, Wis.

H. P. FURLONG has been named assistant to D. P. CARTER in the New York office of the W. W. Sly Manufacturing Co., Cleveland, Ohio.

J. T. HORSBURGH of the Horsburgh & Scott Co., Cleveland, Ohio, has just returned from a trip to Europe where he has been making an extensive study of foreign gear and worm grinding practices and machines.

EARL M. HARTRIDGE, vice-president of the Allied Machine Tool Corp., of America arrived in Paris shortly before New Years.

H. R. ATWATER, formerly sales manager of the Osborn Co., is the Pacific Coast representative of the W. W. Sly Manufacturing Co., Cleveland, Ohio. He is located at 1407 Detroit St., Hollywood, Calif.

R. G. HOLMES has been transferred from the Detroit to the Chicago office of the Consolidated Machine Tool Corp. of America, Rochester, N. Y.

RAYMOND C. DAVIS, formerly with Manning, Maxwell & Moore and the Fairbanks Co., New York, has joined the forces of Hill, Clarke & Co., Boston. He will represent the company in the Connecticut district with headquarters at New Haven, Conn.

J. R. CAMM, formerly with the Cleveland office of the Kearney & Trecker Corp., Milwaukee, has become associated with the machine tool sales department of the Cleveland Tool & Supply Co., Cleveland, Ohio.

W. C. STEVENS, general sales manager for the Cutler-Hammer Manufacturing Co., Milwaukee, has been made a director of developments for all departments.

W. M. PATTISON, head of the W. M. Pattison Supply Co., Cleveland, has been re-elected president of the East Cleveland city commission.

ARTHUR JACKSON, Toronto, Canada, has been appointed Canadian agent by the Cleveland Automatic Machine Co., Cleveland, Ohio. For some time past Mr. Jackson has been in Japan for machinery interests. He opens his own office in Toronto, where he will specialize in automatic equipment.

C. J. SCUDDER, acting superintendent of motive power and equipment of the D. L. & W. railroad with headquarters in Scranton. Pa.. has been appointed superintendent of motor power and equipment.

CHARLES D. TERRY, who has been connected with National Tube Co. since 1897, and since 1911 has been located at general office, Pittsburgh, Pa., as assistant to general superintendent, has resigned to become vice-president of the Boss Manufacturing Co. of Kewanee, Ill.

VICTOR R. WILLOUGHBY, acting general mechanical engineer of the American Car & Foundry Co., has been appointed general mechanical engineer in charge of the engineering section, with headquarters in New York City.

J. A. V. SCHECKENBACH has been appointed general improvement engineer in charge of the improvement and research department of the American Car & Foundry Co., with headquarters in New York City.

A. M. ROPER, formerly secretary treasurer and general manager of the Roper, Harris & Dunn Co., Greenville, Texas, has been appointed general sales manager for the automobile department of the Alvord Reamer & Tool Co., Millersburg, Pa.

JOSEPH E. FIELDS has been appointed general sales manager of the Maxwell Motors Corp., New York, to succeed ARTHUR E. BARKER, deceased.

W. H. SAGSTETTER, formerly of Wabash, Ind., recently was made president of the Salt Lake Iron & Steel Co., of Salt Lake City, a concern purchased a short time ago by the Pittsburg Boiler & Machine Co., of Pittsburg, Kan., in which Mr. Sagstetter has been vice-president and a stockholder. Although Mr. Sagstetter will become president of this company, he still retains his position as vice-president of the Pittsburg, Kan., concern.

GEORGE A. BARCLAY has been appointed superintendent of the rolling mills of the Lackawanna plant of the Bethlehem Steel Co. at Buffalo. Mr. Barclay succeeds H. J. KELLY, who recently resigned.

WILLARD H. BURGARD succeeds GEORGE A. BARCLAY as superintendent of the No. 1 rail mill, Lackawanna plant, Bethlehem Steel Co.

COLIN CAMPBELL, general sales manager of the Chevrolet Motor Co., has resigned and C. E. DAWSON has been appointed acting general sales manager.

C. H. DAVIES, for many years in the employ of S. F. Bowser & Co., Fort Wayne, Ind., has assumed charge of the factory sales promotion division of the Bowser organization with headquarters in Fort Wayne. Mr. Davies relieves L. E. PORTER, assistant general manager, of this branch of the promotional work and will work in collaboration with T. D. KINGSLEY, general sales manager.

WILLIAM HENDRIE has been elected president of the Hamilton Bridge Works Co., Ltd., to succeed his brother, the late SIR JOHN HENDRIE.

FREDERICK P. NEHRBAS has accepted a position with the Templar Motor Car Co. in Cleveland.

W. S. KNUDSON has been made general manager of operations of the Chevrolet Motor Co., Detroit, Mich.

F. G. LANGBEIN is the treasurer of the St. Louis Steel Casting Co., St. Louis, Mo.

G. M. DICKSON, vice-president of the National Motors Corp., Indianapolis, Ind., has resigned. He continues as president of the old National Motor Car & Vehicle Corp., the assets of which were taken over a year ago by the National Motors Corp.

JOSEPH TEIPEL has been named president of the St. Louis Steel Casting Co., St. Louis, Mo.

J. H. LITTLE, director of purchases of the Durant Motors Corp., has been granted a leave of absence to accompany his wife who is ill, to California.

GUS OLSON, JR., formerly sales engineer with the Yellow Sleeve-Valve Engine Works, has become branch manager for the William Esley Machinery Co., Chicago.

W. F. EXNER has been named secretary of the St. Louis Steel Casting Co., St. Louis, Mo.

FREDERICK M. BECKET, chief metallurgist of the Electro Metallurgical Co., and vice-president of the Union Carbide & Carbon Research Laboratories, Inc. (both subsidiaries of the Union Carbide & Carbon Corp.) was awarded the Perkin Medal of the Society of Chemical Industry, on Jan. 11, 1924, for his achievements in the field of applied chemistry.

Obituaries

ARTHUR MELVILL WHITE, superintendent of the American Locomotive Co., Schenectady, N. Y., died recently in that city. Mr. White had been superintendent of the factory for the past twenty years. Previous to this connection he had been with the Bloods Locomotive Works, Manchester, N. H., the Cooke Locomotive Works of Paterson, N. J., and the Rome Locomotive Works, Rome, N. Y. He was born in Ghent, Ohio, in 1846.

W. A. WINBURN, president of the Central of Georgia Railway Co., died recently at Rochester, Minn., at the age of 60 years, following an operation for a tumor. He had apparently been recovering from the first operation, and his death came as a surprise. He was president of the Central of Georgia for a period of nearly ten years.

HOWARD R. HUGHES, aged 54 years, president of the Hughes Tool Co., one of the wealthiest men in Texas, and brother of Major Rupert Hughes, the author, dropped dead at his office in Houston, Texas, recently.

HOMER B. BELFIELD, for 28 years connected with the Billings & Spencer Co., Hartford, Conn., died at the Hartford Hospital Jan. 14, following an operation. At the time of his death Mr. Belfield was purchasing agent for the Billings & Spencer Co., and was a prominent figure in Masonic circles throughout the state.

EDWARD G. RIGGS, executive assistant to the president of the New York, New Haven & Hartford R. R., died recently at his home in Brooklyn.

ROBERT H. ROESEN, aged 33 years, son of the late Oscar Roesen, former vice-president of R. Hoe & Co., died recently at his home in Brooklyn. Mr. Roesen was well known in printing and mechanical circles.

Business Items

The Motch & Merryweather Machinery Co., Detroit, Mich., has moved from the Majestic Building to the third floor of the Curtis Building, 2,842 West Grand Boulevard.

The Gilman Manufacturing Co., Boston, Mass., tools and machinery, is capitalized for $1,000,000. George H. Gilman is president of the concern.

The Firth-Stirling Steel Co., New York City, announces a reduction in the price of stainless steel to fifty cents base per pound f.o.b. the mill.

A new Ingersoll milling planer, costing approximately $21,000, has been purchased by the Western Gas Construction Co., Fort Wayne, Ind., and is now being installed in the machine shop at the plant.

The Kenney Machinery Co. is moving to the Southwest corner of Maryland St. and Senate Ave., Indianapolis, Ind.

The Gary Screw & Bolt Co., Gary, Ind., has increased its capital from $1,000,000 to $2,000,000.

The National Marking Machine Co., Cincinnati, has moved into its new plant at 4022 Cherry St., Cincinnati. The new location affords more than 40,000 sq.ft. for manufacturing purposes.

The Bay State Forge Co. has been organized at Springfield, Mass. with J. H. G. Williams, general manager.

The St. Louis Steel Casting Co. has been organized with temporary headquarters at 3,432 Potomac St., St. Louis, Mo. A new plant is under construction at 100 Malt St. and offices will be opened there about Feb. 1. It is expected that by March 15 the plant will be in full operation.

The Metallurgical Service Co., standard heat treating equipment and supplies, has been organized by M. M. Salkover at 405 Mercantile Library Building Cincinnati, Ohio.

The Allied Die Casting Co., Long Island City, N. Y. has been organized recently.

The Refrigerating Machinery Co., distributors in New England for the Frick Co., of Pa., has moved from 19 Whitney Ave., to the Engineering Building, 207 Orange St., New Haven, Conn.

The General Motors Corp. has purchased the Armstrong Spring Co., Flint, Mich., which has become the Armstrong spring division of the corporation.

The Southern branch of the Westinghouse Electric & Manufacturing Co., of Atlanta, announced recently that the Mann Electric Supply Co., of Columbia, S. C., has been named state distributor in South Carolina of the Westinghouse products, including motors, meters, transformers, etc.

The Mill Supply Co. is the name of a new firm in the machine tool and mill supply field chartered recently at New Bern, N. C., with a capital of $150,000. W. B. Blades, A. F. Patterson, both of New Bern, and others, are named as incorporators.

It has been announced by officials of the Rabe Pipe & Foundry Co., of Chattanooga, Tenn., that Frank Gebbie, of Rochester, N. Y., and associates, have purchased a controlling interest in the business, and will continue full operation of the properties. A change in official personnel also is announced, Mr. Gebbie becoming president.

The Riter-Conley Co., Pittsburgh, Pa., has been granted a charter in Wisconsin as a foreign corporation. The application was signed by C. D. Marshall, H. H. McClintic, W. S. Mitchell, E. J. Patterson. Of the capital, $100,000 is used in Wisconsin. The company is executing a contract for a new gas holder of 6,000,000 cu.ft capacity for the Milwaukee Gas Light Co. at Milwaukee.

The Time-O-Stat Corp., Milwaukee, is a new Wisconsin corporation organized by J. A. Dietrich, Julian Olds and T. F. Egan for the purpose of manufacturing and dealing in time recording instruments, mechanical devices, machinery, etc. The capital stock is $150,000. The incorporators are members of a legal firm and are not ready to divulge the identity of the interests for whom they are acting.

The Seamless Tube Co. of Wisconsin has acquired the shop group at 1160-1170 Spencer St. in Appleton, Wis., formerly occupied by the defunct Reliance Motor Truck Co., and later taken over by the Appleton Motor Truck Co. Alterations are now being made and equipment is being purchased for producing seamless steel tubes.

The Wausau Abrasives Co., 1007 South Second Ave., Wausau, Wis., is in the market for additional equipment for a $50,000 works extension, contracts for which have been placed. The concern manufactures grinding wheels, sandpaper and other abrasives for the metal trades and woodworking industry.

The Nickel Plate system and the Chesapeake & Ohio Railroad are now controlled by the Van Sweringen interests, their hold on the Chesapeake & Ohio having been materially increased as the result of purchases in the open market during 1923.

The Central of Georgia Railroad Co. has definitely decided to rebuild its shops at Savannah, Ga., recently destroyed by fire at a loss of $1,000,000, including much of the equipment.

Cost of Living Shows Decrease

The cost of living in the United States on Dec. 15, 1923, had decreased two tenths of one per cent from the level of Nov. 15, 1923, as shown by figures just collected by the National Industrial Conference Board. In the month from Nov. 15, 1923, to Dec. 15, 1923, there was an increase in the average cost of clothing and a decrease for food. These changes were each less than one per cent. There were also decreases in coal prices in some of the larger cities, but these were not sufficiently important to justify any change in the level of fuel prices for the country as a whole. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and December, 1923, the cost of living decreased 19.3 per cent. The increase since July, 1914, was 65 per cent.

Name Representatives for Council

Representatives of national engineering organizations on the Executive Board of the American Engineering Council for the coming year have been chosen as follows:

American Society of Mechanical Engineers—Dean M. E. Cooley, University of Michigan; Dean A. H. Greene, Jr., Princeton; F. K. Copeland, Chicago; L. P. Alford, Fred R. Low and Major Fred J. Miller, New York.

American Institute of Electrical Engineers—Col. J. H. Finney, Washington; Prof. Dugald C. Jackson, Massachusetts Institute of Technology; C. E. Skinner, Pittsburgh; F. B. Jewett and L. F. Morehouse, New York.

M. G. Lloyd, chief of the Safety Section of the U. S. Bureau of Standards, will represent the American Society of Safety Engineers; S. H. McCrory, U. S. Bureau of Public Roads, the American Society of Agricultural Engineers, and H. E. Howe, Washington, the American Institute of Chemical Engineers.

For purposes of organization the country has been divided into eight districts, which will be represented on the Executive Board by the following:

District No. 1, Hubert E. Collins, Utica, N. Y.; District No. 2, W. H. Hoyt, Duluth, Minn.; District No. 3, C. R. Gow, Boston; District No. 4, Arthur R. Cruse, Philadelphia; District No. 5, John S. Barelli, New Orleans; District No. 6; C. M. Buck, Topeka, Kan.; District No. 7, O. H. Koch, Dallas, Tex.; District No. 8, J. C. Ralston, Spokane, Wash.

The St. Paul Engineers Club has been admitted to membership.

Jerome Strauss Talks at A. S. S. T. Meeting

The New York chapter of the American Society for Steel Treating held a joint meeting with the New Jersey Chemical Society at Stetter's restaurant, Newark, N. J., Jan. 14. Dinner was served at six-thirty o'clock, after which an illustrated talk was given by Jerome Strauss, metallurgist and material engineer, U. S. Naval Gun Factory, Washington, D. C. The subject was "Corrosion Resistant Metals, Particularly Stainless Steel," and Mr. Strauss clearly described the physical and chemical properties of various alloys, particularly in relation to corrosion by sea water. The address was followed by several reels of moving pictures that showed various phases of the steel industry.

Electric Railways Plan Large Expenditures

Electric railways of the United States purchased 4,029 new cars and locomotives in 1923, more than in any year since 1913, and 14 per cent more than in 1922, according to the *Electric Railway Journal*. In addition, they rebuilt 1,256 cars and purchased 621 new motor buses. They built 1,114 miles of track, including 260 miles of extension lines.

Exclusive of amounts for labor, they expended $282,000,000 during 1923 in the purchase of new plant and equipment and maintenance materials. They plan to expend $262,000,000 for the same items in 1924.

News of Washington Activities

By Paul Wooton

American manufacturers of metal-working machinery, say observers of the Department of Commerce, are not taking the same systematic steps in the countries now offering greatest market potentialities as they did before the war in the countries which were largest purchasers of American machinery.

During the five-year period ended June 30, 1914, Germany absorbed an annual average of more than $2,125,000 worth of American machine tools. England took something over $2,000,000 worth annually; France more than $1,000,000; Canada, about $1,000,000; Russia, $460,000; Belgium, $429,000; Austria, $327,000; Italy, $256,000. Six of these countries were regarded as our most dangerous competitors, yet with all the competition we manage to sell large supplies of machinery in countries capable of duplicating nearly anything which we can manufacture. If the methods employed to get that business were invoked in India, Japan, Argentina and other countries, where the domestic metal-working machinery industry is not well developed, it is believed sales could be increased very greatly.

Engineers and the Government

In addition to grouping public works functions in a department of the Federal Government, Secretary Hoover, in the course of an address before the Public Works Conference in Washington Jan. 10, advocated a further grouping of industrial and engineering activities.

The tendency on the part of engineers as a class not to participate in the conduct of public affairs led Secretary Hoover, in the course of remarks at the annual dinner of the American Engineering Council, Jan. 10, to declare that "we had better reduce the volume of science and applied science we are pouring into our young men in order to make room for some stimulation of their public relationships, some realization of their public obligations."

In telling of the objectives of the Engineering Council, of which Mr. Hoover was one of the founders, he said that it was felt that the engineer is in a position to be particularly helpful in tempering those great conflicting forces represented by labor and by employer.

Immigration Laws

The immigration bill which will be considered in the near future by the House of Representatives will reduce by 50 per cent the amount of immigration to the United States. A proposal to suspend all immigration for five years was lost by only one vote in the committee. The bill approved by the House committee provides for the selection of immigrants by American consuls.

The restrictions which have been agreed upon will allow some increase in the quotas from the countries of northern Europe but reduce greatly the number of southern Europeans who are to be admissible. The Italian quota, for instance, is cut from 42,000 to 4,000. The basis of the committee's action was 2 per cent of the nationals of the various countries who were resident in the United States in 1890.

Legislation authorizing the United States Shipping Board to allocate $10,000,000 of its construction appropriation to a special fund to be used in installing internal combustion engines and auxiliary apparatus in shipping board vessels and in lending money to private ship-owners for the same purpose will be recommended by the House committee on merchant marine and fisheries.

The future of the seas, particularly as applies to cargo vessels on long routes, belongs to ships with Diesel type motive power, Admiral Benson told the committee. Because of its experience and its observation, the shipping board desires to equip 50 vessels with these engines and to encourage private owners to convert their ships likewise, he asserted.

Railroads Show Big Yearly Gains

With the Lehigh Valley leading the list, seventy-four leading railroads of the United States in the year just closed reported an average percentage gain of 26.5 per cent over 1922. The Lehigh Valley showed an increase in 1923 net amounting to 873 per cent over 1922 net, which was low because of the coal strike in that year. Three other railroads, the Chicago & Great Western, the Duluth, South Shore & Atlantic and the Wheeling & Lake Erie all showed increases of about 600 per cent in comparison with the previous year.

These figures, compiled by the Standard Statistics Co., showed that the net earnings of the seventy-four companies included in the list earned $893,979,000, an increase of $187,214,000 over 1922.

Figures on the Yearly Expenditures

Another remarkable fact disclosed by the earnings is that the gross revenues of the same roads were only 13.6 per cent higher, and that unusually heavy expenditures were made on maintenance. The compensation showed that only seventeen of the seventy-four have lower indicated net earnings for 1923 than for 1922.

Some of the roads will report a deficit for the year, the estimates of the Standard Statistics showed. The estimated net earnings of the Denver & Rio Grande Western showed a decline of 42.3 per cent, the Maine Central of 33.2 per cent, the Boston & Maine 53.7 per cent and the Chicago, St. Paul, Minneapolis & Omaha 25.4 per cent.

Indicating the prosperous year that the railroads enjoyed, the statistics show that only two of the seventy-four companies reported a decline in gross revenues, despite the fact that seventeen failed to earn as great net incomes due to the heavy expenditures.

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NOW THAT WE'RE TUNED IN

Orr in the Chicago Tribune

The German Machinery Industry in 1923

Despite the Ruhr and Rhineland, business was done in this unusual country—Labor activities curbed—Troubles for the coming year

By Our Berlin Correspondent

THE YEAR 1923 has been an eventful one for German machinery building. This industry has passed through the most complete series of adversities conceivable. The Ruhr occupancy has set into motion all the latent destructive forces that played havoc with the country's economic structure.

The disorganization of the supply of basic material, the collapse of the country's finances to the verge of bankruptcy, the complete depreciation of the currency leading into a state in which practically no currency existed, loss of foreign markets and the threatening disintegration of the State, marked the course of the year.

It is inconceivable that any line of industry could exist under such conditions and survive, but the German machine tool industry has done both and has done it surprisingly well. It emerges from the turmoil doubtless impaired in financial strength, but with unbroken vitality and with sufficient bouyancy to start again an uphill fight against tremendous odds. Apparently undaunted by the strongest economical convulsions that a country can suffer, German machinery building is seen at the end of the year engaging in a hard, determined battle with labor.

In blockaded Rhineland and the Ruhr, the industry was kept going after nearly all of the other wheels of the immense production machinery had come to a standstill. In the German interior it also evidenced remarkably strong powers of resistance. Business continued in a fair degree, when there seemed to be no solid foundation to work upon.

The break down of the market in the middle of the year coincided with the time, when the adverse influences of the Ruhr war reached a stage of full maturity. It stood, however, in no direct relation to the Ruhr war. Its immediate cause is found in the excesses of inflation that shattered the last remnants of the basis of prices. The anticipation of further depreciation led to an ever increasing inflation of prices.

Labor and Prices

The upward flight of prices is commonly ascribed to the rise of labor cost. This opinion is not corroborated by facts. The dangerous proceeding to adjust wages on the scale of a theoretical pre-war currency in times of the wildest fluctuations has certainly added to the momentum of the price movement, but it is easily discovered that the latter has impelled the wages movement and not vice versa.

The pre-war wages varied for trained machinists from 50-70 pfennig according to locality. The increase of labor cost can be safely assumed to be in the neighborhood of 200 per cent. Judging from past experience, the influence of such wage levels upon prices will be a price standard between the double and the treble of pre-war prices. The remarkable fact that with about one-third of pre-war wages and all the other elements of inflation, German machine tool building has just been able to produce at pre-war cost. This supports the assertion now being made by manufacturers that with about 70 per cent of pre-war wages they cannot compete against foreign rivals, unless in every other respect pre-war conditions are restored.

This contention is not a standpoint adopted for the purpose of excessive profits. It represents the conviction of manufacturers maintained even in the face of the facts, and it is at the same time an admission of their incapability to deal with the cost problem like manufacturers in other countries have done under similar circumstances. The combined efforts of German industry, greatly strengthened by the tidal wave of unemployment, are at the end of the year near the point of bearing fruit.

Eight-Hour Day Killed

The eight-hour work day which was introduced by the demobilization ordinances, is—if appearances do not deceive—a thing of the past. It died with the expiration of the latter, which doubtless will not be revived. It is intended to settle the question of the working day in a special law that has been in contemplation for more than a year. Probably the matter will remain unsettled by law and decided by actual practice. The ten-hour work day has established itself already in a considerable number of machinery factories by agreement between employer and workmen.

In almost everyone of such instances the pre-war wage system has been reintroduced, especially with regard to pure piece work payment at rates below the pre-war level. Complements and personnel have been sifted and greatly reduced. Of the so-called revolutionary achievements of labor, only the shop council law remains, which, although a sore in the flesh, is considered by employers the least of all evils. The cumulative settlement of labor questions between employers' associations and unions is clearly on the wane and is giving place to individual arrangements. The wages tariff is still officially binding both the employers and the employees, but is frequently overridden by individual agreements.

The state of chaos, that the year 1923 produced and the weakened situation in which it has placed labor, has afforded the manufacturers the hoped-for chance of remodeling the labor problem. As a body they have been rather slow to recognize this, but several pioneers have been eager to grasp it. Precedents are thus established that will probably be followed by the rest, as long as labor is in no position to fight back. The ill wind which has blown during the whole year has brought back to manufacturers a fair part of their lost rights.

The observation made in the first paragraphs with regard to the comparatively strong position that the industry was able to maintain during the whole year, is corroborated by the foreign trade returns. The machinery exports of the year up to September—as far as official data are available shows a decline of 32 per cent compared with the corresponding period of 1922. It must be remembered, however, that conditions in Rhineland and the Ruhr practically excluded this territory from export and that a large part of the visible decline is doubtless due to this fact. Moreover, one line of machinery building — railway engines — takes a share of no less than 73,000 tons or 67 per cent in the total decline of 109,470 tons. The total export of the machinery industry from January to September, 1923, was 230,069 tons compared with 339,539 tons in the same period of 1922. The corresponding export of 1913 was 400,000 tons in a round figure. The import amounted to 4,245 tons compared with 8,068 tons in 1922 and 49,871 tons in 1913. While the export has dropped to about 58 per cent of that of 1913, the import was only 10 per cent. The following figures show the export of the main groups of machine building in 1923 (January-September) compared with the corresponding period of 1922.

	1913	1922	1923
	416,031	339,539	230,069
Railway engines, tons	56,183	97,243	24,140
Power generating machinery, steam engines, turbines, combustion motors, etc.	58,457	27,346	23,333
Machinery for textile industry	49,832	28,231	31,035
Metal working machine tools	55,752	37,769	26,420
Wood working machine tools	9,166	10,724	9,595
Forging machinery	1,711	1,873	781
Agricultural machinery	63,066	46,334	37,549
Hoisting machinery	4,840	11,029	6,059
Printing presses	8,942	8,773	8,432

Considering that the report from Rhineland and Ruhr, such as there was, is not included in the official figures given and that they represent the export of the German interior only, the result is under the circumstances remarkably good. The machine tool industry suffered a loss of 30 per cent of its export business during the first nine month of the year.

Machine Tool Exports Increased

It is most remarkable, however, to see that the number of machine tools exported has increased. It was 81,369 in 1922, and 85,023 in 1923. The corresponding number in 1913 was 74,000. As German manufacturers have reduced the weight of machine tools in relation to the size only in a slight degree, it is obvious that light machinery now predominates in the export business. In fact the absence of the export of heavy machine tools produced in the Ruhr and Rhineland is responsible to a large degree for the smaller average of weight. For this absence the Ruhr war is not the sole reason as the decline of the export business of

this class of machine tools dates back much farther. While in 1913 the average weight of exported machine tools was still 700 kg., it has dropped to 470 kg. in 1922 and to 310 kg. in 1923. The export of machine tools during the consecutive months of 1923 up to September can be seen from the following:

Machine Tool Exports

JANUARY—SEPTEMBER

	1923		1922	
	Metric Tons	Pieces	Metric Tons	Pieces
January	4,025	9,870	5,338	10,316
February	3,447	7,989	5,762	9,528
March	2,905	9,199	5,493	7,416
April	2,761	10,374	4,486	9,837
May	2,482	11,051	3,495	8,067
June	2,490	9,735	3,919	9,560
July	2,236	9,903	2,982	9,376
August	3,019	9,356	3,882	10,127
September	3,056	7,546	2,412	7,147
	26,421	85,023	37,769	81,360

	Metric Tons	Pieces
Monthly average 1923	2,934	9,447
1922	4,196	9,040
1913	5,808	8,314

As can be seen the curve of decline reached its lowest point in the middle of the year. In August and September a slight recovery is noticeable. From intermediate reports it would appear that the export of the last months of the year has dropped again. This can hardly be the case, however, as a large amount of finished machinery has accumulated in the Rhenish and Ruhr works toward a possibility of shipping that is bound to materially increase the export figures of November and December.

Pamphlets Received

Relative Efficiency of Direct and Geared Drive Propellers. By Walter S. Diehl. Government Printing Office, Washington, D. C. The National Advisory Committee for Aeronautics has published Report No. 178 which contains interesting data on the above named subject. The report is short and contains tables of comparative figures on two and four blade propellers and diagrams showing effects obtained by both.

Japan—Before and After the Earthquake. American Bankers Association. Fred I. Kent, chairman of the commission on commerce and marine, Bankers Trust Co., New York City. This is an extract from trade information bulletin by F. R. Eldridge, chief of the Far Eastern Division, Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., and is an exhaustive study of conditions in Japan both before and after the September earthquake.

Wages and Hours of Labor in the Automobile Industry. Government Printing Office, Washington, D. C. This bulletin covers the period of 1922 and is prepared by the Bureau of Labor Statistics of the U. S. Department of Labor.

Effect of "Added" Sulfur on Structural, Forging and Rail Steels. The American Society for Testing Materials, Philadelphia, Pa. This is the second preliminary report of the joint committee of investigation of phosphorus and sulfur in steel published by permission of the U. S. Bureau of Standards.

Annual Report of the Secretary of the Navy. Government Printing Office, Washington, D. C. This report covers the fiscal year ending Nov. 15, 1923.

Stresses in a Few Welded and Riveted Tanks Tested Under Hydrostatic Pressure. By A. Stang and T. W. Greene. Government Printing Office, Washington, D. C. This is technologic paper No. 243 of the Bureau of Standards and contains interesting illustrations, descriptions and data.

Our World Trade. U. S. Chamber of Commerce, Washington, D. C. Many interesting tables of exports and imports are to be found in this pamphlet recently issued by the foreign commerce department of the U. S. Chamber of Commerce. The report covered a period from January to September, 1923.

Trade Catalogs

Measuring Tapes, Rules and Mechanical Tools. The Lufkin Rule Co., 106-110 Lafayette St., New York City. Various tapes, tape reels, micrometers, calipers, squares, dividers, thickness gages, rules, gaging rods, "T" squares, sticks, with graduations and other data are described in this catalog of 166 pages.

Forges and Blowers. The Buffalo Forge Co., Buffalo, N. Y. Forges and blowers for work in almost every conceivable kind of a shop are shown by illustration and description. Specifications are also given. Other products of the company such as reboring machines, power drills, bench drills, punches, shears and bar cutters, combination woodworkers and other machinery are also included in the catalog.

Drills, Reamers, Sockets, Counter-bores, Mills, Screw Extractors, Arbors and Mandrels. The Cleveland Twist Drill Co., Cleveland, Ohio. Catalog Forty is the title of this new publication. It contains descriptions of the above listed products and the booklet has a thumb index making it an easy reference book.

Woodworking machinery. The Oliver Machinery Co., Grand Rapids, Mich. There are three hundred and twenty 6x9 pages in this unusual catalog which is number 22 with board covers. It is the first catalog since May, 1918, that this company has issued and contains a wealth of information on not only woodworking machinery but also on all sorts of machines used by pattern makers, and other products of this company. It will be noted that great strides have been made in safeguarding devises by this company. These catalogs are for general distribution and will be sent to interested parties.

Saws. E. C. Atkins & Co., Indianapolis, Ind. Saws of every description are described in the new Atkins catalog that contains two hundred and sixty-eight 7x10 pages and is bound with board covers in a most attractive style. There are enough data, dimensions and specifications in the catalog to form a valuable reference book for anyone in the lumber, furniture or woodworking business and the firm states that it will send copies to those interested. The catalog is number 19.

Tumbling Mills. The W. W. Sly Manufacturing Co., 4700 Train Ave., Cleveland, Ohio. Excellent illustrations and reproductions of blue prints showing the merits of the Sly tumbling mills make up catalog S-99 that has just been issued. The booklet is in a light blue cover green lettered and sectional drawings and other data show how the product is used.

Seamless Steel Tubes. National Tube Co., Frick Building, Pittsburgh, Pa. The "Shelby" seamless steel tubes and how they are made is the text of the booklet that has just been distributed. Pictures showing the various parts of the factory and descriptions of the work as it is done are contained in the publication.

Gears. The Grant Gear Works, Boston, Mass. The catalog and price list of this company has been issued for the year 1924. It contains a list of gears carried in stock for immediate delivery and also gears made and cut to order. The data on gears contained in this little booklet are invaluable to users.

Turning, Straightening and Polishing Machines. The Medart Co., St. Louis, Mo. Bar-straightening machines, tool-grinding machines, bar-turning machines, bar pointers, bar-facing machines and other products are shown in this catalog. The booklet is profusely illustrated and has made valuable tables of dimensions.

Broaching Machines. The Oilgear Co., 60-62-64 Twenty-seventh St., Milwaukee, Wis. Detachable sheets are to be found in this publication of the Oilgear Co. containing much information on this subject as well as on other products made by the company. Illustrations, diagrams, tables and specifications are found on the sheets.

Turbine Blowers. The L. J. Wing Manufacturing Co., 352-362 West 13th St., New York City. This is bulletin 67 and contains descriptions of the blower and the parts of the blower manufactured by this company. Diagrams show the workings of the product and tables show speeds and pressures.

Pulleys. Winfield J. Smith, 10-16 Lock St., Buffalo, N. Y. Grooved and crown-faced pulleys and other machinery are listed and illustrated in a recent catalog issued by Mr. Smith.

Air Operated Arbor Presses. The Hannifin Manufacturing Co., Chicago, Ill. Catalog AR contains illustrations and drawings of various air operated arbor presses made by this company. The catalog is in handy size and neatly printed.

Brinell Hardness Numbers. The Tinius Olsen Testing Machine Co., 500 North Twelfth St., Philadelphia, Pa. This company is distributing a celluloid card of the Brinell hardness numbers.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Airplane motors and instrument boards, searchlights, sirens and rockets. Berlin, Germany, Purchase. Reference No. 8865.

Portable band saws. Bonacca, Honduras. Purchase, Reference No. 8816.

Engines and tools for wood and iron working. Berlin, Germany. Purchase. Reference No. 8865.

Forthcoming Meetings

American Society of Safety Engineers. Annual Meeting. Engineering Societies Building, 29 W. 39th St., New York City. Jan. 22.

Engineering Section of the National Safety Council. Joint meeting with the American Society of Safety Engineers. Engineering Societies Building, 29 W. 39th St., New York City. Jan. 22.

American Society for Steel Treating. Winter sectional meeting. Hotel Seneca, Rochester, N. Y., Jan. 31 and Feb. 1, W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual meeting, Jan. 22 to 25, at the General Motors Building, Detroit, Mich. Coker F. Clarkson, 29 W. 39th St., secretary.

American Gear Manufacturers Association. Spring Meeting, April 28, 29 and 30, 1924. Lafayette Hotel, Buffalo, N. Y. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

Society of Industrial Engineers. Eleventh annual convention. Buffalo, N. Y. April 30, May 1 and 2. Headquarters, 608 S. Dearborn St., Chicago, George C. Dent, executive secretary.

American Society of Mechanical Engineers. Spring meeting. Cleveland, Ohio. May 19, 20, 21 and 22. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

Southern Supply & Machinery Dealers Association, National Supply & Machinery Dealers Association, and American Supply & Machinery Manufacturers Association. Triple convention, May 19, 20 and 21, 1924, Hotel Cleveland, Cleveland, Ohio. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York City.

Foreign Trade Council. Eleventh annual convention at Boston, June 4, 5 and 6. O. K. Davis, India House, Hanover Square, New York City, secretary.

The General Committee of Division V, Mechanical of the American Railway Association. Convention and exhibits. Atlantic City, June 11-18, 1924. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

Railway Supply Manufacturers Association. Exhibit. Atlantic City, June 11-18, 1924.

The Lyons Fair. Lyons, France. March 3 to 17, 1924. Information furnished by Emile Garden, 50 Church St., New York City.

New and Enlarged Shops

Machine Tools Wanted

D. C., Wash.—Southern R.R. Co., 17th St. and Pennsylvania Ave., C. R. Craig, Genl. Purch. Agt.—one 42 in. car wheel press, 400 ton.

Ill., Chicago—J. Hess, 1207 South Western Ave. (machine shop)—No. 4 punch press.

Ill., Chicago—Illinois Central R.R., 135 East 11th Pl., J. J. Bennett, Purch. Agt.—boring mill, horizontal press, drilling and milling machines for proposed shops at Evansville, Ind.

Ill., Peoria—Office of United States Engineer—receiving bids until Jan. 28 for one gear lathe and one lathe chuck.

Ind., Connersville — McQuay-Wainwright-Norris Mfg. Co. (manufacturer of piston rings), H. A. Wainwright, Purch. Agt.—one drilling and one milling machine, also furnace for heat treatment of steel.

Ind., Evansville—A. L. Maxville Co., 2nd and Vine Sts., B. Diehl, Secy.—equipment for proposed $40,000 addition to garage and service station.

Ind., Fort Wayne—C. F. Carlson, Genl. Delivery—small chuck and lathe.

Ind., Indianapolis—Standard Oil Co. of Indiana, Davidson and Lord Sts.—several drill presses, radial drills and planers, all motor driven, for shops at Whiting.

Ind., Lamar—B. W. Hubschman Co.—boring machines, drill press, grinder, small tools and machinery for garage and repair shop.

Ind., Princeton—Toney Motor Co., B. D. Toney, Secy.—press, drill, grinder, cylinder reboring machine, etc., for garage, to replace that which was destroyed by fire.

Ind., Salem—Gwinnup Blacksmith Shop—drill press (used).

Mich., Detroit—Detroit Motor Valve Co., Rivard and Maple Sts.—one medium size press.

Mich., Hudson—H. S. Graves—special machinery and equipment for the manufacture of chemical fire extinguishers; also automobile lathes, milling and drilling machines.

Mich., St. Clair—W. D. Allen (machine shop)—lathe, turret head, to handle ⅞ or 1 in. round stock.

Mich., Sturgis—Ford Garage—boring machine, small drill and other machine tools for addition to garage and service station.

Minn., St. Paul—Great Northern R.R., Metropolitan Life Bldg., F. A. Bushnell, Purch. Agt.—one 9 ft. motor driven radial drill.

Mo., Joplin—Metz Bros., 1301 Joplin St., R. Metz, Purch. Agt.—18 in. x 10 ft. lathe for automobile repairs.

Mo., Kansas City—Acme Electric Co., 2121 East 39th St.—open back inclinable fly wheel or back geared punch press, about 45 ton capacity (used).

Mo., St. Louis—Perfection Mfg. Co., 2701 North Leffingwell Ave. (manufacturer of novelties)—high speed riveting hammer for ¾ in. and lighter rivets, also double crank punch press, bed opening about 20 x 24 in.

Mo., St. Louis—W. Schild Mfg. Co., 619 North 2nd St. (iron works)—engine lathe, 10 to 12 ft. long, 20 to 24 ft. swing, quick change gears, graduated compound rest, hollow spindle, chuck and face plates, for thread cutting (used).

N. Y. Buffalo—Cottrell Vulcanizing Wks., 2808 Bailey Ave.—small drill and tools for garage repair shop.

N. Y., Buffalo—J. Lorenzo, 21 Gold St.—small repair tools and drill for garage.

N. Y., Buffalo—Natl. Biscuit Co., 245 Urban St.—tools and equipment for proposed $45,000 garage and repair shop.

N. Y., Oneonta—Public Service Garage, C. H. Epps, Purch. Agt.—small lathe, tools, drill press and equipment for proposed garage.

N. Y., Utica—J. Burhyte, 142-146 Liberty St.—10 to 12 in. lathe, presses, tools and equipment for garage repair shop.

N. Y., Utica—J. Polombe, 2605 Genesee St.—small tools and 10 in. lathe for garage.

O., Cleveland—P. A. Geier Co., 540 East 105th St., F. J. Groton, Secy.—boring machines, chucks, lathes, mortisers, welders, drilling and cutting machines, die casting machine, automatic turret machine, etc., for addition to machine works.

O., Cleveland—G. B. Hooper, 308 Euclid Ave.—complete equipment, including forges, drills, welders, etc., for locomotive and car repair shops at Seth, W. Va.

O., Cleveland—Riverview Improvement Co., 907 Natl. City Bldg., R. Cook, Secy.—drills, presses, single capacity motor driven air compressor and other tools for garage and shop at Rocky River.

O., Lakewood—Detroit-Bonnie View Garage, Detroit and Bonnie View Aves.—cylinder reboring machine and portable electric grinder.

O., Sandusky—Mid West Hotel Corp., J. H. Hermann, Dir.—cylinder boring machine, welder, battery charging outfit, air compressor, etc., for garage and repair shop.

Pa., Catasauqua—McLaughlin Motor Co., D. McLaughlin, Purch. Agt.—equipment, tools and small lathe for new garage.

Pa., East Pittsburgh—Westinghouse Electric & Mfg. Co.—about fifty machine tools, including lathes, drill presses, grinders, boring mills, presses, hammers, milling and riveting machines, riddles, slotters and drills.

Pa., Erie—Murphy Bros., 32 North Park Row—sheet metal working machinery and equipment, including bending and cutting machines, etc.

Pa., Spangler—C. E. Schlicher — motor driven forge, welder, boring machine, drill press, lathe, etc., for 2 story machine and forge shop at Bakerton.

Tex., Bonham—Catron Mfg. Co., Inc., Box 31—lathe, 18 or 20 in. swing.

Wis., Arcadia—Trempealean Co., E. F. Rotering, Hy. Comr.—lathe, drill press, etc., for proposed $40,000 machine and repair shop, to replace fire loss.

Wis., Barton—A. Duenkel—automobile repair machinery for proposed garage.

Wis., Milwaukee—Dale's Service Sta., 1290 Kinnickinnie Ave., D. Defenderfer, Purch. Agt.—grinder and drill for automobile repairs.

Wis., Milwaukee—Zuehlke-Stoehr Heating Co., 236 24th St.—pipe cutting machine.

Wis., West Allis—Mertz-Knippel Co., 6620 Greenfield Ave.—repair tools for proposed $40,000 garage.

N. S., Truro—N. McMillan—lathe, press and small tools for automobile repairs.

Ont., Merrickville—J. D. Crawford—small lathe and repair equipment for garage.

Que., Lake Megantic—Blais & Boulanger—small lathe and grinder for garage.

Machinery Wanted

Calif., Fresno—Service Rock Co., Valley Bank Bldg.—20 ton locomotive crane.

Calif., La Jolla—D. A. Weir, 7888 Girard Ave.—newspaper press and job printing press.

Calif., San Francisco—Amer. River Bldg. Materials Co., J. E. Cook, interested, 719 Crocker Bldg.—rock crushing equipment, etc.

Calif., San Francisco — Clover Valley Lumber Co., Alexander Bldg.—two 10 ton traveling cranes.

Calif., San Francisco—Pacific Portland Cement Co., Pacific Bldg.—one 15 ton, 5 yd. bucket traveling crane.

Ill., Chicago—Amer. Insulated Wire & Cable Co., 954 West 21st St.—bulldozer to make insulator copper lengths.

Ill., Chicago—Swift & Co., 76 West Monroe St.—refrigeration machinery for branch at Ishpeming, Mich.

Ill., Chicago—Tin Shop, 1121 South Newberry St.—42 in. tinners bar folder.

Ill., Chicago—Wanner Mchy. Co., 716 Scuth Dearborn St.—19x25 in. Scott drum pony press.

Ill., Decatur—H. F. Wright, Secy.—machinery for flour and feed mill at Evansville.

Ill., East St. Louis—East St. Louis Daily Journal, Missouri Ave. near Collinsville Ave., J. Camp, Purch. Agt.—complete engraving outfit.

Ind., Boonville—Moses-Rosenthal Underwear Co.—knitting machines, looms, etc., for underwear factory.

Ind., Connorsville—M. Yetta (automobile bodies)—tinners brake.

Ind., East Connorsville (Connorsville P. O.)—W. Goodwin—tinners brake.

Ind., Evansville—Keller-Crescent Printing Co., 216 Locust St.—printing presses, lithographing, transmission and conveying machinery for 1 story addition to plant.

Ind., Fort Wayne—C. N. Braun, 217 East Berry St. (woodworking machinery)—lock corner cutter, setting-up machine and trimmer; Hooper or Morgan 2 color box board printer; Morgan, Doig or Saranac corrugated fastener driver; Morgan or Doig combined nailing and cleating machines; veneer clipper; hawker dowel machine; Nash sander, No. 5 preferred; channel iron roller bearing dry kiln trucks; knife grinder, large size preferred; Smith & Phillips No. 3 window frame machine; vertical hollow chisel mortiser; New Britain chain mortiser, No. 2 or No. 7 preferred; one single end and one crate head tenoner; crate head coupler; tilting table saw bench.

Ind., Indianapolis — G. K. Henderson, Secy., 230 West McCarty St.—printing plant equipment, including motor driven printing presses, typesetters and binders.

Ind., Indianapolis—Wayne Knitting Mills, J. Doermer, Supt.—knitting machines, looms and equipment for proposed branch plant at Paulding, O.

Ind., Lagrange—Lagrange Lumber & Coal Co.—machinery and equipment, including cutoff saws, planer, circle saw, etc., for planing mill, to replace fire loss.

Ind., Mishawaka—Secretary Bd. Educ.—complete vocational equipment for new school.

Ind., Mishawaka—Sinclair Refining Co.—single stage motor driven air compressor for new gasoline and service station.

Ind., Muncie—J. W. Johnson, 718 North Walnut St. — complete blacksmith shop equipment, including blower, forge, etc.

Ind., Petersburg — A. Hoaggatt — grain milling machinery and equipment.

Ind., Shelbyville—C. F. and H. Sindlinger—machinery and equipment for $40,000 cold storage plant.

Ind., South Bend—Midwest Stone Quarry Co., 514 Traction Terminal Bldg., E. B. Taylor, Greencastle, Mgr.—machinery and equipment for $50,000 addition to stone crushing plant, to replace fire loss.

Ind., Wabash—Honeywell Heating & Ventilating Co.—machinery, tools and equipment for addition to plant for the manufacture of heating and ventilating apparatus and supplies.

Ind., Waterloo — Standard Oil Co. of Indiana—complete machinery, tools and equipment, including motor driven air compressor, for gasoline service station.

Ky., Madisonville—Riverside Coke & Iron Co.—fifty coke ovens.

Mass., Boston—Stone & Webster, Inc., 147 Milk St.—100 ton overhead crane for proposed generating plant of the Montaup Electric Co. at Somerset.

Mass., Cambridge—Whiting Milk Co., 158 Massachusetts Ave.—equipment, including forge, blower, power hammer, shear and small tools, for proposed forge and blacksmith shop.

Mass., North Adams—M. Manes, 138 Church St.—paper mill and conveying machinery for proposed $150,000 plant at Pownal, Vt.

Mass., Stoneham (Branch of Boston)—manual training equipment, including lathe, planer, matcher, bandsaw, circular saw, sander, pulleys, shafting, belting, small tools, etc., for new high school.

Mich., Battle Creek—Print Shop, Box 502—linotype machine.

Mich., Columbiaville — Columbiaville Woolen Mills, Inc.—looms, spindles, etc., for $100,000 mill.

Mich., Escanaba—Hansen & Johnson, 116 North 3rd St.—air compressor, gasoline pumps and small tools for garage.

Mich., Highland Park (Branch of Detroit)—Ford Motor Car Co., E. Ford, Pres.—1,000 lb. electric lift about hoist for hydro-electric plant at Iron Mountain.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—No. 2 foundry iron firmer at Birmingham. Maximum quotation $23 against $22 per ton last week. Better demand for basic iron also. Pig-iron output slightly increased. Iron and steel scrap prices tending higher. While there is no immediate prospect of higher steel prices, the increase in December unfilled tonnage shows an awakening of demand; this would serve to forestall any decline from the $2.40 base on bars and $2.50 per 100 lb., level for plates and shapes. Active buying in steel sheets; prices firmer.

Advances—Tone of copper market better; prices stiffening. Tin up ¼c. per lb. in week. Lead firm at present levels. Zinc market firmer; prices steadily advancing. Antimony tending higher in New York warehouses. Babbitt metal advanced in Cleveland. Cotton waste rose abruptly in New York and Cleveland, owing to high price of cotton. Linseed oil up 1c. per gal. in New York, during week.

Declines—Fabricated brass and copper products lower in Cleveland warehouses.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$25.05
Northern Basic	24.00
Southern Ohio No. 2	24.00
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	28.00
BIRMINGHAM	
No. 2 Foundry	22@23
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.25
Virginia No. 2	28.17
Basic	24.00
Grey Forge	24.00
CHICAGO	
No. 2 Foundry local	24.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	27.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.77
Basic	25.77
Bessemer	26.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh	New York	Cleveland	Chicago
No. 10	3.00	4.34	3.75	4.00
No. 12	3.10	4.39	3.80	4.05
No. 14	3.20	4.44	3.85	4.10
No. 16	3.40	4.54	3.95	4.20
Black				
Nos. 17 and 21	3.70	4.55	4.45	4.70
Nos. 22 and 24	3.75	4.60	4.50	4.70
Nos. 25 and 26	3.80	4.65	4.55	4.75
No. 28	3.85	4.75	4.65	4.85
Galvanized				
Nos. 10 and 11	4.00	4.80	4.70	4.85
Nos. 12 and 14	4.10	4.90	4.80	4.95
Nos. 17 and 21	4.40	5.20	5.10	5.24
Nos. 22 and 24	4.55	5.35	5.25	5.40
No. 26	4.70	5.45	5.50	5.55
No. 28	5.00	5.75	5.80	5.85

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded	48%	34%	55½%	43½%	50%	37%
2½ to 6 in. steel lap welded	44%	30%	53½%	40½%	47%	34%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%; class A, plus 23%. Cast iron, standard sizes, 34% off.

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ½-in. to 1-in., O.D., weighing 0,17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
½	$0.09	50%	⅞	$0.16	35%
⅝	.11	45%	1	.18	31%
¾	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.53	8.00	6.70
Hoop steel	5.19	4.66	4.55
Cold rolled strip steel	7.50	8.25	8.35
Floor plates	5.80	5.66	5.80
Cold drawn shafting or screw	4.40	3.90	4.30
Cold drawn flats, squares	4.90	4.40	4.80
Structural shapes (base)	3.64	3.46	3.30
Soft steel bars (base)	3.54	3.36	3.20
Soft steel bar shapes (base)	3.54	3.36	3.20
Soft steel bands (base)	4.39	3.61	3.95
Tank plates (base)	3.64	3.46	3.30
Bar iron (3.10@3.15 at mill)	3.54	3.36	3.20
Tool steel	11.00	....	....
Drill rod (from list)	55%	40@55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ¼, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			13.00
Tin, 5-ton lots, New York			49.37½
Lead (up to carlots), St. Louis	8.25	New York	8.87½
Zinc (up to carlots), St. Louis	6.42½	New York	7.12½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	27.00	28.50
Antimony (Chinese), ton spot	11.50	11.50	10.25
Copper sheets, base	20.50	20.75	23.00
Copper wire, base	16.00	18.50	16.25
Copper bars, base	19.50	22.00	19.50
Copper tubing, base	22.50	26.75	23.00
Brass sheets, base	17.25	21.50	18.75
Brass tubing, base	21.50	26.50	20.50
Brass rods, base	15.00	17.50	15.75
Brass wire, base	17.75	21.50	....
Zinc sheets (casks)	10.75@11	10.45	....
Solder (½ and ½), (case lots)	34.75	31.75	30.00
Babbitt metal (83% tin)	52.00	61.00	48@52
Babbitt metal (35% tin)	25.00	20.50	22@25
Nickel (ingot and shot)	29.00	....	....
Nickel (electrolytic)	32.00	....	35.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel sheet (base)	57.00
Hot rolled rods, Grade "A" (base)	55.00
Cold drawn rods, Grade "A" (base)	63.00

Shop Materials and Supplies

METALS—Continued

Copper nickel ingots	37.00
Hot rolled copper nickel rods (base)	45.00
Manganese nickel hot rolled rods "E"—low manganese (base)	57.00
Manganese nickel hot rolled rods "D"—high manganese (base)	60.00

Base price of monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	11.7	10.75	11.50
Copper, heavy, and wire	10.75	10.25	10.75
Copper, light, and bottoms	9.50	8.50	9.75
Lead, heavy	5.75	6.50	6.00
Lead, tea	4.75	4.00	5.00
Brass, heavy, yellow	7.00		7.25
Brass, heavy, red	8.75	9.25	9.00
Brass, light	6.25	4.75	6.25
No. 1 yellow brass turnings	7.00	5.75	6.75
Zinc	3.75	2.75	3.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	$25.10	$22.85	$18.50
"A" Grade:				
IC,	20x28, 112 sheets	21.40	18.00	17.00
	Coke Plates—Primes, 20x28 in.			
100-lb.,	112 sheets	14.00	13.00	14.0
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	8.25	6.55	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.14@0.21	$0.20	$0.14
Cotton waste, colored, per lb.	.09@.12½	.17	.10½
Wiping cloths, 13¼x13¼, per lb	10.50	36.00 per M	.16
Wiping cloths, 13¼x20½, per lb.	11.00	52.00 per M	.16
Sal soda, per 100 lb.	2.40	2.25	2.65
Roll sulphur, per 100 lb.	3.60	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.95	1.00	.94
Lard cutting oil, 25% lard, per gal.	.55	.50	.67½
Lard oil, pure, per gal, 2 to 5 bbl. lots	1.03	1.01	.97
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.29	.35	.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 2c. per sq.in., per ply:			
Medium grade	40–2½%	30–10%	30–10%
Heavy grade	30–5%	30%	20–5–2½%
Rubber and duck:			
First grade	50–10–5%	50–10%	40–10%
Second grade	60–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$6.30	$5.84	$6.48
Emery paper	9.90	11.00	8.80
Emery cloth	31.12	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.40
Cloth	3.38	2.67	3.20
Fire clay, per 100 lb. bag		.65	.60
Coke, prompt furnace, Connellsville	per net ton		3.75@4.00
Coke, prompt foundry, Connellsville	per net ton		5.00@6.50
White lead, dry or in oil	100 lb. kegs		New York, 14.25
Red lead, dry	100 lb. kegs		New York, 14.25
Red lead, in oil	100 lb. kegs		New York, 15.75

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting	per lb.	0.044	0.044	0.039
Brass rods	per lb	0.15	0.155	0.17
Solder (½ and ½)	per lb.	0.3475	0.3375	0.29
Cotton waste	per lb.	.11@.14	.11@.14	0.11½
Washers, cast iron (½ in.)	per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.02
Lard cutting oil	per gal.	0.55	0.55	0.50
Machine oil	per gal.	0.29	0.29	0.33
Belting, leather, medium	off list	40–2½%	30–10%	30–10%
Machine bolts up to 1x30 in.	off list	45%	45%	40%

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	45%	60%	50–5%
1½ and 1½x3 in. up to 12 in.	15%	50–5%	50%
With cold punched hex. nuts up to 1 in. diam. (plus std. extra of 10%)	30%	$3.50 net	.....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	35%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	List net	List net	.....
Hex. head and hex. nut bolts	List net	.....	65–5%
Lag screws, coach screws	45%	.....	60–5%
Square and hex. head cap screws	60%	70%	70–10%
Carriage bolts, up to 1 in.x30 in.	35%	50%	50–5%
Bolt ends, with hot pressed nuts	45%	.....	55%
Tap bolts, hex. head, list plus	35%	.....	.....
Semi-finished nuts, 7/16 and smaller	65%	.....	.....
Semi-finished nuts, ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.50	$4.00	$4.00
Washers, cast iron, ⅝ in., per 100 lb. (net)	5.50	4.00	4.00
Washers, round plate, per 100 lb. Off list	1.50	4.00	4.00
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	3.50
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	3.50
Rivets:			
Rivets, 7/16 in. dia. and smaller	50%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ⅜-in., ½-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.60	$3.75
Cone heads, ditto (net)	5.20	3.80	3.85
1½ to 2-in. long, all diameters, *EXTRA* per 100 lb.	0.25	.....	0.15
⅜ in. diameter *EXTRA*	0.35	.....	0.15
½ in. diameter *EXTRA*	0.75	.....	0.50
1 in. long, and shorter *EXTRA*	0.75	.....	0.50
Longer than 5 in. *EXTRA*	0.50	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.45	.....	$3.70 base

Mo., Kansas City—Print Shop, 601 Gumbel Bldg.—job printing press.

Mo., Marshall—A. Wagle—job printing press, belting, hangers and pulleys.

Mo., St. Louis—A. N. Beeman, 5788 West Florissant Ave.—three gasoline pumps, three underground gasoline tanks, air tanks, etc., for filling station.

N. J., Newark—Hay Fdry. & Iron Wks., Plum Point Lane—one angle shear, capacity 1 x 8 x 8 in.

N. Y., Brooklyn—M. C. Illions, 2789 Ocean Parkway—wood carving machine, Victory or Lochman.

N. Y., Buffalo—Buffalo Bed Spring Co., 154 Oak St.—machinery for small addition to factory.

N. Y., Buffalo—Lakeside Candy Co., 30 Sherman St.—candy making machinery.

N. Y., Fairport—Fairport Fdry.—complete equipment to replace fire loss.

N. Y., Hoosick Falls—Hoosick Falls Brush Co., Inc., W. Haynes, Pres.—one automatic brush filling machine and five sanding wheels mounted on arbors, etc.

N. Y., Oswego—Deep Rock Spring Co., G. W. Bush, 213 West 1st St., Pres.—machinery and equipment to enlarge plant for the manufacture of soft drinks.

N. Y., Rochester—R. Levin, 84 Hanover St.—complete bakery equipment, including ovens, to replace fire loss.

N. Y., Waterford—Ford Mfg. Co., J. W. Ford, Pres.—spring needle knitting machines for underwear, cotton carding machinery, etc.

O., Akron—Sackman Mfg. Co., 171 Quaker St.—gas hardening furnace, emery stand disk grinder with 2 x 12 in. wheel, also 18 in. wheel.

O., Brookville—A. E. Hull Pottery Co., H. S. Hull, Mgr.—machinery to increase capacity of plant.

O., Cleveland—Brooks Oil Co., Inc., 3304 East 87th St.—one double stage, motor driven air compressor with auxiliary equipment, for service station.

O., Cleveland—Cleveland Desk Co., 1380 Ontario St.—small machines and equipment for woodworking repair shop.

O., Cleveland—Private Investment Co., 1836 Euclid Ave., A. C. Lehman, Mgr.—complete machinery and equipment, including air compressor and small tools for $125,000 garage and repair shop.

O., Columbus—Claycroft Brick & Mining Co., Hartman Bldg., P. C. Hedges, Genl. Mgr.—large crusher for brick plant at Shawnee.

O., Columbus—Columbus Lumber Co., 640 Jefferson Ave., E. McElravey, Supt.—cutoff saw, rip saw and molder.

O., Danbury—A. W. Kalb—electric refrigeration machinery, including compressor, condensor, receiver, separator, gages, coils, etc.

O., Findlay—Star Equipment Co.—complete machinery and equipment for factory for the manufacture of steel parts.

O., Kansas—Taxpayer (newspaper)—linotype, folder, stitcher, perforator and numbering machine.

O., Lakewood—M. Eckstrom, 17453 Woodford Ave.—one small motor driven a.c. portable drill.

O., Lakewood—M. Lewis, Madison Ave. and Wascana St.—motor driven medium size riveting machine for sheet metal works.

O., Lakewood—H. Tritsch, 13320 Madison Ave., N. W.—small machine for winding radio tuning coils.

O., Middletown—L. E. Kittle, Box 444—machinery and equipment for the manufacture of Reed shock absorbers.

O., Shelby—Bd. Educ., R. L. Sawyer, Clk.—screw lathe, circle saw, small boring machine and other small tools and machinery, motor driven, for vocational shop.

O., Vermilion—Lampe Constr. & Trading Co., E. G. Lampe, Mgr.—complete machinery and equipment for proposed $50,000 factory for development of deposits of Fullers earth.

O., Willard—Willard Times—stereotype and metal saw.

Okla., Tulsa—Public Service Co., 107 East 4th St.—$160,000 worth of ice making equipment.

Pa., Clairton—Bd. Educ.—manual training equipment for new high school.

Pa., Jeannette—Elliott Co.—one small electric crane.

Pa., Mausdale—W. K. Savage—complete machinery and equipment for flour mill, to replace fire loss.

Pa., Phoenixville—Phoenixville Publishing Co.—10 x 15 in. Chandler & Price or Gordon press with Miller feeder.

Pa., Zelienople—Iron City Sanitary Mfg. Co.—5 ton crane, 63 in cupola.

Tenn., Nashville—Standard, Box 342—paper cutter.

Tex., Dallas—Bakery, 2918 San Jacinto St.—2 barrel dough mixer, belt driven.

Tex., Dallas—J. P. Bryant, 1605 Main St.—job printing press, 4 x 6 in. preferred.

Tex., Galveston—Office of United States Engineer, 305 Trust Bldg.—one small steam locomotive crane on creeper truck or caterpillar traction, 35.4 ft. boom, ¾ yd. bucket.

Tex., Madisonville—W. L. Turner—diamond job press and quarto cylinder press, Babcock or Cottrell preferred.

Wis., Beloit—Matson & Ruegger, 907 St. Lawrence Ave.—air compressor, gasoline tanks and pumps.

Wis., Cedar Grove—Cedar Grove Shoe Mfg. Co.—lasting machine, vamper and stitcher.

Wis., Evansville—Evansville Grain & Feed Co.—grinding machinery, belting and shafting for proposed $40,000 feed mill.

Wis., Green Bay—Northern Paper Mills, foot of Day St., H. Benton, Secy.—special equipment for proposed $75,000 filtering plant.

Wis., Janesville—Parker Pen Co., Division and Court Sts.—special machinery for proposed factory.

Wis., Livingston—E. Biddick Co. (grain elevator)—grain crushing and conveying machinery.

Wis., Madison—Heilprin & Co., West Mifflin St., E. Tough, Washington Bldg., Purch. Agt.—refrigeration machinery for warehouse.

Wis., Madison—L. J. Schultz, 1326 West Washington Ave.—36 in. sander (used preferred).

Wis., Manitowoc—J. Weyer, Washington and 17th Sts.—medium size cutoff saw for woodworking shop.

Wis., Milwaukee—Economy Paper Co., c/o A. L. Ebert, 64 Cawker Bldg.—paper cutting machine.

Wis., Milwaukee—Office of United States Engineer, Federal Bldg., G. V. Wilke, Purch. Agt.—one cable cutting machine to cut steel wire rope up to 1¼ in. diameter.

Wis., Nelma—Nelma Mfg. Co., C. M. Christiansen, Phelps, Purch. Agt.—resaw, bandsaw and belting for sawmill.

Wis., Oshkosh—Stroud-Doyle Co., 43 Main St.—gasoline tanks and pumps for proposed filling station.

B. C., Port Hammond—D. M. Hartnell & Co.—equipment for proposed $200,000 sawmill at Port Coquitlam.

Ont., Brinston—C. W. Barkley—bench tools, lathe and tire shrinker for blacksmith shop.

Ont., Brockville—G. Beacock, 4 Clarissa St.—compressor for garage.

Ont., Chatham—Green River Bottling Co.—complete bottling and sterilizing equipment, also tanks for proposed soft drink plant.

Ont., Chesterville—G. C. Lacy—job printing press.

Ont., Crysler—H. Vershon—forge, tools, etc., for blacksmith shop.

Ont., Guelph—Lander Bros. Hosiery Mills—equipment for the manufacture of hosiery.

Ont., Hamilton—Hoover Suction Sweeper Co., Gage Ave.—special equipment for the manufacture of vacuum cleaners.

Ont., Heckston—C. Sloan (sawmill)—bandsaw, possibly other equipment.

Ont., Iroquois—J. Markee, R. R. 1—forge, vise, etc., for blacksmith shop.

Que., Beebe—C. D. Beerworth (printer)—paper cutting machine.

Que., Birchton—R. A. Taylor—resaw, possibly belting, etc., for planing mill.

Que., Lennoxville—Balfour & Beck, Main St., A. O. Beck, Purch. Agt.—printing press.

Que., Magog—A. C. Milton—resaw and bandsaw.

Que., Montreal—Holdsworth & Co., Ltd., Favard St., W. Holdsworth, Purch. Agt.—equipment for shrinking and dyeing cloth.

Que., Montreal—R. N. Taylor & Co., Ltd., 522 St. Catherine St., W.—machinery and equipment for the manufacture of optical goods, surgical and electrical instruments.

Que., Richmond—Times-Quardian Co.—cylinder press and paper cutter.

Que., St. Hermenegilde—M. Lemieux—woodworking machinery, including lathe and jointer.

Que., Sherbrooke—A. D. Desilets, 306 Wellington St. (cabinet maker)—woodworking equipment.

Que., Sherbrooke—J. Dufresne & Co., Ltee., 25 King St.—candy making machinery.

Que., Verdun—A. P. Currotte, 721 Gertrude St.—complete sawmill equipment.

Metal Working Shops

Calif., Los Angeles—The Los Angeles Gas & Electric Corp., 645 South Hill St., will build a 1 story, 134 x 134 ft. garage on 6th St.

Calif., Los Angeles—The Mack International Motor Truck Co., 1628 East 7th St., plans to build a 1 and 2 story, 275 x 975 ft. service and storage plant on Alameda St. Cost will exceed $200,000.

Calif., Santa Monica—F. and H. McMahan awarded the contract for the construction of a 1 story, 135 x 150 ft. garage, etc. on Euclid Ave. Estimated cost $55,000.

O., Cleveland—J. Babin, Williamson Bldg., is receiving bids and will open same about Feb. 2 for the construction of a 3 story, 55 x 160 ft. garage at 3602 Euclid Ave. Estimated cost $150,000. N. Petti, Williamson Bldg., Archt.

O., Cleveland—C. E. Tyler, 3172 East 80th St., is receiving bids for the construction of a 1 story, 40 x 136 ft. garage. Estimated cost $40,000. T. C. Cerny, 4025 East 52nd St., Archt.

O., Lakewood—H. A. Dempsey, 17419 Clifton Blvd., awarded the contract for the construction of a 1 story, 50 x 136 ft. garage at 13300 Madison Ave. Estimated cost $40,000.

Pa., Grove City—The Patterson Gear-Shift Co., Monaca, plans to build a factory for the manufacture of gear shifts, here. Estimated cost $65,000. Engineer or architect not selected.

Pa., Pittsburgh—The Barnes Motor Co., 119 South Hiland St., awarded the contract for the construction of a 1 story, 42 x 127 ft. and 69 x 117 ft. automobile service station and garage on Hamilton Ave. Estimated cost $46,000.

Pa., Pittsburgh—The Phillips Mine & Mill Supply Co., Mary St., awarded the contract for alterations and the construction of a 1 story, 47 x 122 ft. addition to plant, to replace fire loss. Estimated cost $40,000.

Pa., Pittsburgh—The Presto Lite Co., 30 East 42nd St., New York, awarded the contract for the construction of an addition to its plant, including cylinder repair, weighing and garage buildings, alterations and additions to loading platform, main purifier and acetone buildings on Lincoln Ave., here. Estimated cost $40,000.

Pa., Pittsburgh—The Zang Lesher Co., 5474 Penn Ave., is having plans prepared for the construction of a 1 story, 74 x 106 ft. factory for the manufacture of automobile tops. Estimated cost $40,000. Private plans.

Tenn., Chattanooga—The Citizens Automobile Co., 7th and Broad Sts., awarded the contract for the construction of a 1 story garage. Estimated cost $40,000.

Tenn., Chattanooga—The Turnbull Cone Mchy. Co., Fort and 14th Sts., plans to build a 4 story, 50 x 120 ft. factory. Estimated cost $40,000.

Wis., Fond du Lac—The Anderson Motor Co., c/o B. Anderson, 36 East 2nd St., plans to build a 2 story, 47 x 120 ft. garage. Estimated cost $50,000. Engineer or architect not selected.

Wis., Kenosha—P. Pirsch & Co., Fairfield Ave., awarded the contract for the construction of a 1 story, 100 x 202 ft. factory for the manufacture of fire apparatus. Estimated cost $60,000. Noted Jan. 3.

Wis., Menomonie — E. V. Johnson will soon receive bids for the construction of a 1 story, 60 x 176 ft. garage on Main St. Estimated cost $50,000. Private plans.

Wis., Milwaukee—The Bartles-Maguire Oil Co., 539 Bway., is having preliminary plans prepared for the construction of a 1 story, 75 x 102 ft. service station on Sycamore St. Estimated cost $100,000. Buemming & Guth, 521 Jackson St., Milwaukee, Archts.

Wis., Milwaukee—The city voted $250,000 bonds for the construction of a central repair plant. C. E. Malig, City Hall, Archt.

Wis., Milwaukee—H. E. Weber, 582 Jefferson St., will soon award the contract for the construction of a 1 story, 120 x 128 ft. garage on Van Buren St. Estimated cost $100,000. Van Ryn & De Gelleke, 114 Grand Ave., Milwaukee, Archts. Noted Oct. 25.

Wis., Wauwatosa—The Milwaukee Structural Steel Co., 19th St. and St. Paul Ave., awarded the contract for the construction of a 1 story, 120 x 300 ft. fabricating plant on Watertown Rd. Estimated cost $75,000.

Wis., Wisconsin Rapids—J. E. Daly, 101 2nd St., is having plans prepared for the construction of a 1 story, 54 x 100 ft. garage. Estimated cost $45,000. F. J. Henry, Wisconsin Rapids, Archt.